REPORT ON FLOOD PROTECTION

FOR THE

CITY OF COLUMBUS, OHIO.

1913

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O. S. U.

STATE UNIVERSITY.

PRELIMINARY COPY

OF

Summary and Estimates

FROM THE

Report on Flood Protection

FOR THE

CITY OF COLUMBUS, OHIO

September 15, 1913

JOHN W. ALVORD and CHAS. B. BURDICK
Hydraulic and Sanitary Engineers
Hartford Building
Chicago

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OHIO STATE
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BOARD OF

United States Army Engineers.

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Columbus, Ohio, September 15, 1913.

Hon. George J. Karb,

Mayor, Columbus, Ohio.

Dear Sir—The Board finds that the projects submitted to it fall into two classes, those involving reservoirs and those without reservoirs.

The Board is unanimously of the opinion that Project No. 9 is the best of the first class and Project No. 7 the best of the second. These projects the Board believes are equally good and either will be a practical solution of the problem at Columbus and will fit well into any general plan for the improvements of the Scioto River.

In view of the fact that there are likely to be local protests against high reservoir dams the Board recommends Project No. 7 as being more practicable. The interests of navigation will not be injuriously affected.

FOR THE BOARD,

Francis R. Shunk,

Lt. Col. U. S. Engineers.

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PART I.

Summary and Conclusions.

In our investigation for the purpose of recommending flood protection for the City of Columbus, we have been instructed to cover the widest possible scope. All reasonable methods of flood protection have therefore been considered. As a result of these studies, we present herewith, in tabular form, for final conclusions:

First—Sketch plans showing the more important elements of each of the ten projects which we have thought worthy of detailed study and estimate.

Second—A table giving the general estimate of each project.

Third—Tables showing their comparative cost.

Fourth—A diagram showing the factor of safety in each of the two classes of projects for which estimates have been made.

The conclusions as a result of our study are as follows:

1. It is concluded that the maximum flow of the flood of 1913 at Columbus was, in round numbers, 140,000 cubic feet per second. Of this total, approximately 80,000 cubic feet came down the Scioto, and 60,000 cubic feet from the Olentangy River at the apex of the flood, and the average flows for 24 hours at the flood apex were 68,000 and 51,000 second-feet in the Scioto and Olentangy, respectively, or 119,000 total.
2. Past records show that the average combined 24 hour flood of the Scioto and Olentangy is about 33,800 cubic feet per second, and that the flood of March, 1913, was therefore 3.52 times greater than the average flood.
3. Studies of other floods and flood data generally would indicate that, so far as records are available, the flood of March, 1913, was A GREAT FLOOD, practically without precedent on this or other rivers of the eastern United States. Circumstances may occur to produce a greater flood hereafter, but it is not probable that such flood will greatly exceed the flood just past.
4. We conclude, from a study of the rainfall, that the storm which produced the flood of March, 1913, especially in the extent of territory which was covered, was one of

the greatest ever known in this country, east of the Pacific Coast.

5. For the purpose of the protection of the City of Columbus against floods, means should be considered by which a maximum flood flow of not less than 150,000 cubic feet per second could be safely carried through the city, with such clearance below bridges and excess height in embankments as would prevent debris from reducing the available cross-section or create accidents at the time of greatest emergency.

6. It is thought desirable, further, to consider the means by which floods of more than 200,000 cubic feet per second can be cared for in a similar manner, so that the authorities and the public may have their choice as to the amount and extent of flood protection which should be introduced at this time, for the size of future floods can not be accurately predicted.

7. It is believed that channels or flood relief measures based on either of these two stated flow rates should be so proportioned and so safeguarded by height of levee, clearance below bridges, and factor of safety, that the channels which convey them could, on emergency, carry one-half more than the computed flow before a great calamity or disaster similar to that of March, 1913, would occur.

8. Reservoirs on the upper watershed have been found practicable, at reasonable cost, and for projects to carry 200,000 cubic feet per second, a combination of reservoirs and new channels in the city is the cheaper, but for flows of 150,000 cubic feet per second, projects for channels alone are slightly the cheaper.

9. Reservoirs aid not only Columbus but Delaware and the entire valley, even as far as Chillicothe. Should any combination of interests be effected, and these benefits taken into consideration, projects in which reservoirs are combined with channels will have an advantage over all others.

10. Studies on the automatic control of flood flow by the detaining type of reservoirs have shown that with two reservoirs on the same stream, one above the other, the second adds but little to the total efficiency.

11. Further studies on this type of reservoir seem to show that with one reservoir on each river of the capacities here possible, a single reservoir on one of the rivers will be almost as effective in detaining the flood apex at Columbus as will the two. It has not been thought advisable, however, to reduce the estimated cost of reservoirs below two—one on each river—at this stage in the comparison of projects. If however, a single reservoir is ultimately found to be practicable, it would reduce the cost of all the reservoir projects herein by $1,146,000—the cost of the Delaware reservoir project.

12. It has been determined that the cost of flood protection in the ten projects which have been investigated ranges from about $10,000,000 to about $23,000,000, in round numbers, and that no practicable measure of flood relief can be had at much less cost than the lowest figure mentioned, and that no greater sum could profitably be spent at this time than the higher sum mentioned.

13. The present value of the district flooded in March, 1913, all told, is estimated at the sum of about fifty millions of dollars.

    It is further found that the damage done by the flood of March, 1913, as closely as it can be estimated, amounted to the sum of $5,600,000, in round numbers, and that this does not include the depreciation in real estate values caused by the flood.

14. The annual flood damage for the past fifteen years in Columbus is not less than about $540,000 per annum, and, based on financial considerations alone, this would warrant the expenditure of about $10,800,000 to prevent the recurrence of flood disasters.

15. Undoubtedly the loss of life, distress, shock, and suffering caused by such a catastrophe would warrant a greater expenditure than this if it were found to be necessary.

16. It is believed that adequate flood relief, which will be safe, permanent, and satisfactory, can be had for about $10,000,000, or $11,000,000.

17. It is found that Projects Nos. 1 to 6, inclusive, are excluded both on the ground of their cost and for other lack of adaptability.

18. Projects Nos. 9 and 10, combining reservoirs with channels, are not favored unless State aid and the co-operation of other municipalities benefited be obtained. As between reservoir projects built by Columbus for its own protection, and channel projects of equal cost, we favor channel projects as being a more simple and reassuring method to the public directly concerned.

19. Projects Nos. 7 and 8, providing for a flow of 150,000 cubic feet per second across the West Side at May Street, in conjunction with, or without, the old channel, would appear to be the best and most economical projects, all things considered.

20. It is suggested that if the riparian owners will deed to the city their right to the abandoned lands in the present Scioto River channel between Sandusky Street and Mound Street, so that it may be filled and either made into a park, or subdivided and sold off as an asset, that Project No. 7 be adopted. Project No. 7 provides for a new channel across the West Side, known herein as the May Street Cut-off.

21. If such riparian owners do not care to so concede their rights to the city, we would suggest that Project No. 8 be adopted, providing for the retaining of the old channel around the bend, and rebuilding the present bridges so that a flow of 50,000 cubic feet per second could be provided for through the present river around the Bend; the remainder of the flow to be taken through a new channel to be cut across the west side in the vicinity of May Street.

22. Project No. 7, while apparently costing $1,176,000 more than Project No. 8, has the following assets which do not appear in the estimate:

    Sixty-five acres, more or less, of ground on the abandoned channel for park or other purposes.

    Decreased maintenance of two railroad and two highway bridges.

    Greater traffic facility from north to west side.

    In general, more compact, sightly, and improved conditions for the West Side.

23. The total cost of Project No. 7, amounting to $11,283,000, should be properly divided between the steam rail-

roads, the city, the county, and perhaps other corporations or interests that will be benefited more than they will be damaged, and we would suggest that all parties at interest agree upon a Board of Arbitration which shall apportion these costs equitably among the parties at interest so that no time may be lost in proceeding with this great public work.

As a result of the above conclusions, we would briefly review the recommended project and its alternative.

BRIEF DESCRIPTION OF PROJECT No. 7:

This project provides for a total flow of 150,000 cubic feet per second, with a factor of safety which would allow about one-half more flow before overtopping the levees. From the mouth of the Olentangy, where the rivers unite, the flow will be carried south through a new channel in what is called therein the "May Street Cut-off," joining the Scioto River again below Mound Street. The present bed of the Scioto River around the Bend to Mound Street is to be abandoned, filled, and can be made into a park, or boulevard, as may be desired.

The following brief account will give the salient features of this project:

Flood Water Grade.

The height to which it is proposed to allow the flood water to rise while carrying the above described amount of flow is much lower than that produced in the flood of March, 1913, above the city. This lower height is obtained largely by the fact that adequate and direct outlet is obtained through the West Side, and in part by excavation and width of channel.

New Channel in May Street:

The new channel across the West Side will center about on the line of May Street. It will be about 880 feet wide at the top. The east line will be along McDowell Street, and the west line along Skidmore Street. The height of these streets will be raised to 46 feet above city datum, or from 10 to 18 feet above their present level. Outside of the channel on either side it will be necessary to condemn a strip of from one to two blocks in width, so as to create the slopes up to this new level. It is proposed, in the future, to park these two strips of land after they have been filled. About 750 buildings of all classes will have to be condemned and removed.

The sides of the channel will be sloped and sodded, and a level bench about 30 feet wide will be formed just above the low water pool.

The width of the low water channel will be about 600 feet, and the water level held by the dam under the Mound Street bridge will be about 20 feet above city datum. The bottom of the channel will be 12 feet above city datum, giving a depth at low water of 8 feet.

Excavation:

The largest part of the excavation for this project will be taken from the May Street cut-off channel. The largest portion of this excavated material will go into filling up the old river bed around the Bend, if that river is to be filled up through the concessions of the riparian owners.

Levees:

It is intended to protect the northerly line of the West Side by a massive levee constructed along the Scioto River, outside of and north of the C. C. C. & St. L. and the T. & O. C. Railroads. This levee is to have a top width of 100 feet, and a height of 12 feet above the high water mark of the flood herein provided for. It will terminate at the west end in the higher ground near the Asylum, and at Sandusky Street it will connect with an elevated parkway along the west side of the new May Street cut-off channel.

Along the easterly side of the new May Street cut-off channel a new avenue will be opened, on a raised grade, which will pass from Dublin Avenue or Spring Street west of the Hocking Valley Railroad straight south to Mound Street, thus affording a new and important thoroughfare for connecting the West Side with both the north and the south sides of the ciy.

A third levee of importance will run north along the east side of the Olentangy bottoms to the high ground in the vicinity of Third Avenue, thus protecting the district north of the Penitentiary from inundation. This latter levee will be 80 feet in width, and of a sufficient height to be safe against all accidental ice gorges or other unusual conditions.

New Street Bridges:

Three new reinforced concrete arch bridges will cross the new May Street cut-off channel, one each at Broad Street, Town Street, and Mound Street. These will take the traffic to and from the new West Side.

New Railroad Bridges:

Two new railroad bridges will have to be built across the May Street cut-off channel, one for the Pennsylvania and one for the T. & O. C. Railroad. These bridges will be near the northerly end of the channel.

The Sandusky Street Bridge:

The Sandusky Street bridge will be entirely eliminated as the traffic now using that bridge can pass easterly over the Broad Street bridge across the new auxiliary channel at May Street, thence north on the new proposed street which directly connects Spring Street with the West Side.

Present Railroad Bridges:

In case the old channel is abandoned, through the consent of the riparian owners, the four present railroad bridges occupied by the Hocking Valley Railroad, the T. & O. C. Railroad, and the Pennsylvania Railroad may be abandoned, and embankments can take their place.

Present Street Bridges Around the Bend:

In case the riparian owners are willing to convey their rights to the city, the present street bridges over the Scioto around the Bend may be abandoned and filled, embankments taking their place, and their grade materially improved.

Disposition of the Old River Bed:

The old river bed, filled, as it may be, with the excavation taken from the new May Street channel, can be either made into an attractive park, or it may be so subdivided that a broad avenue shall pass through its center connecting with the city streets now existing, and all lands and lots thereby created may be either sold for the benefit of the improvement, or in part transferred to the riparian owners as compensation for their rights.

The Upper Scioto River:

All the low-lying bottom land between the C. C. C. & St. L. Railroad and the Dublin Pike (about 250 acres) should be acquired by the city so as to prevent its occupancy in any way that would deter flood waters from free passage. This tract may be made into a large open common ground, or it may be turned into a park, under certain restrictions.

Grandview Avenue Bridge:

This bridge will be left as it is now, with two spans, but it will be raised 5.6 feet for proper clearance. 1,200 feet of the north

approach road will be converted into a spillway at elevation 40. This road will be paved with brick, and the downstream side protected with rip-rap for this purpose.

C. C. C. &. St. L. Railroad Bridge Over the Scioto River:

This bridge will be enlarged by two additional spans, giving a clear width for the river of 404 feet. It will also have to be considerably raised to secure the necessary clearance for flood water.

The Olentangy River:

It is proposed to buy all the bottom land up the Olentangy valley as far as Dodridge Street bridge (about 540 acres), so that no encroachment of subdivision or building operations shall be made upon the flood water channel of the river.

Street Bridges:

Nearly all of the street bridges on the Olentangy will require some enlargement of their water-way opening, as per the detailed tables submitted in this report.

Levees:

It is not proposed to endeavor to protect the land to the west of the Olentangy River from inundation by this improvement. The easterly levee will be the ony one constructed. This will protect the region north of Spring Street and west of Neil Avenue.

Railroad Bridges:

The railroad bridges crossing the Olentangy River near its mouth will all require some enlargement and alteration in order to give this channel the effective capacity. These changes are more fully described in the report.

The Scioto River Below Mound Street Bridge:

It is proposed to build a levee connecting Mound Street with the Jackson Pike in the vicinity of Greenlawn Avenue. This levee will have a substantial breadth so that it may be converted into a drive, should the future improvements indicate that is desirable.

Some considerable excavation will be necessary in the channel above Sawhill Island and below Mound Street.

The easterly levee below Mound Street will pass around the Franklin Iron Works, and thence south-easterly to the old canal bed and the high ground at a point north of the Greenlawn Avenue bridge, and here it will terminate. Below this point the flood

plain of the river will be used as it now exists, practically between the old canal bed and the Jackson Pike.

Land:

It is proposed that the city shall acquire all of the land below Mound Street to below the Sewage Disposal Plant from the old canal right-of-way on the east side to the rising ground at the Jackson Pike on the west side. This land will comprise about 1,620 acres.

Levees:

The levees around the pumping station and the sewage disposal plant are to be raised and strengthened, but these works are not to be otherwise disturbed.

The old levees immediately along the river below Mound Street may be kept in place so as to protect from ordinary floods. The extraordinary floods which will be expected to overtop them will be confined by the larger levees and the broader flood plain herein provided for.

Mound Street Bridge:

Mound Street will be carried across the new channel on a substantial reinforced concrete arch bridge. Under this bridge there will be a low dam which will control the low water level of the river above it, so that it will form a pool in the new May Street cut-off and above.

Greenlawn Avenue Bridge:

The Greenlaw Avenue bridge will be left practically as it is now, but the approach road will be so lowered, protected, and improved that the water of the greater floods can pass over it without damage.

Municipal Railroad Bridge:

The Municipal Railroad bridge will be left undisturbed.

Frank Road Bridge:

The Frank Road bridge will be left practically intact, but the approach road will be lowered, paved, and so reverted that the flood water may pass over it without damage.

The Scioto River Around the Bend:

This part of the project will be improved as will be indicated by the action of the riparian owners. If they do not feel willing to part with their riparian rights, it is suggested that it be left in its present condition. The bridges will then be replaced with some-

what less opening, as the bulk of the flood water will be carried through the May Street channel. No further improvements will be planned here under these conditions, but the May Street cut-off channel can be somewhat diminished in capacity, as described in Project No. 8.

Storm Water Sewer:

Should the riparian owners be willing to have this old channel filled up and the bridge removed, a large storm water sewer must be built, and connected with all of the sewers and outlets now existing so that its discharge can be delivered to a point below Mound Street.

CONCLUSION.

The above brief description of this improvement will be found to be further supplemented in the report by tables showing the detailed changes necessary in all of the bridges, sketches of the proposed improvement, and cross-sections of the new cut-off channel.

Division of Cost:

The cost of the work is estimated to be $11,263,300, if Project No. 7 can be strictly followed. Of this sum it is believed that a substantial amount should be paid by the railroads, in part for improvements which they will receive, and in part for proportionate cost which they should bear in any measure of flood relief.

Another portion of this amount should be borne by the County in caring for its bridges.

It is believed that the proper method by which these apportionments can be made would be to appoint, with the consent of all the parties at interest, a Board of Arbitration which would fix the proportionate relative costs to be incurred by any and all parties damaged or benefitted.

It is not known accurately what proportion will be necessarily raised by a bond issue by the City of Columbus, but it is believed that it will approximate seven and a half to eight and a half millions of dollars.

Future Programme:

Detailed plans necessary to construct these works are of necessity not complete at this time. Only an outline can be given of the proposed improvement, and their outside cost is all that it is attempted to estimate now. The working out of the detailed plans, the apportionment of the cost and benefits to the various interests

involved, will be a matter of painstaking care for many months to come. The creation of a new river channel through the heart of a populated district, involving, as it does, the condemnation of some 730 buildings, will of necessity occupy the attention of the legal department of the city for some time to come.

SUMMARY OF ADVANTAGES OF RECOMMENDED PROJECT.

The following advantages are found for the project herein recommended:

1. It is believed that it is planned with a factor of safety to make it adequate for the future flood protection of Columbus.
2. The more direct channel-way across May Street is an advantage in considering accidents due to ice gorges, wreckage, floating debris, etc., at the time of large floods.
3. The project has all the elements of simplicity, directness, and visible assurance which can be comprehended by the population it is to serve.
4. It will add a large amount of value to the property in the district east of the new channel by combining it with the heart of Columbus.
5. It will take less miles of levee to protect the West Side than any other project of equal capacity.
6. It will reduce the number of bridges to be built and maintained by the city and county.
7. It will add greatly to the traffic facilities on the West Side by connecting it more directly with both the north and south sides of the city.
8. It will recover more area of valuable land nearer the heart of the city than it will destroy.
9. The new channel for the river traverses the least valuable part of the West Side.
10. This new channel will add greatly to the appearance of that part of the city by the introduction of the adjacent strips of park area, and by the permanent concrete bridges.
11. It will permit the present bed of the Scioto River, consisting of about 65 acres, to became a park or a boulevard, if desired.

12. It will eliminate four railroad bridges completely, substituting only two others.

13. It will amply protect the West Side by the creation of a massive levee 100 ft. broad along its northerly side.

14. In the future, if desired, these levees can become desirable drives or parkways both to the north and the south side.

15. By the necessary acquisition of bottom lands to prevent encroachment, it will create an immense open or common ground for the entire city, which, in a restricted manner, may ultimately be developed into a park system.

16. It will keep the river above Mound Street clean at low water, and create pools or ponds which may be made more sightly and attractive than the present neglected stream.

17. It will inspire confidence on the West Side of Columbus, restore and increase real estate values, and raise that district in the general estimation.

If, therefore, all parties at interest will combine earnestly and honestly to work out to the best possible advantage this great improvement to the City of Columbus, it will not only protect the city from all future catastrophies but greatly improve and facilitate traffic conditions, and eliminate the maintenance of many of the bridges now existing, substituting for some of them permanent and enduring structures which will be an improvement to the general appearance of the city for all time to come.

All of which is respectfully submitted,

ALVORD & BURDICK,

September 15, 1913. Engineers.

DESCRIPTION OF PROJECTS WITH TOTAL COST.

Project No. 1.

Providing for a flow of 200,000 cubic feet per second by widening to about 1,000 feet the Scioto River around the Bend and improving the rivers above and below the city.....$ 23,282,300

Project No. 2.

Providing for a flow of 200,000 cubic feet per second by widening and deepening the Scioto from San-

dusky Street to Mound Street for a capacity of half the total flow, and providing an auxiliary channel across the West Side between Gift and McDowell Streets for the remaining half. Also improving the rivers above and below the city.....$ 22,440,800

Project No. 3.

Providing for a flow of 200,000 cubic feet per second by widening and deepening the Scioto River from Sandusky Street around the Bend to Mound Street for a capacity of half the total flow and providing an auxiliary channel across the Asylum grounds for the remaining half .....$ 21,063,900

Project No. 4.

Providing for a flow of 200,000 cubic feet per second by abandoning the old bed of the Scioto River around the Bend and cutting a new river through the West Side between McDowell Street and Grubb Street; also improving the rivers above and below the city..$ 15,483,700

Project No. 5.

Providing for a flow of 200,000 cubic feet per second by utilizing the Scioto River without material improvement around the Bend to carry a flow of one-quarter of the total, the remaining three-quarters to be conveyed across the West Side by a new channel between McDowell Street and Skidmore Street. The rivers to be improved also above and below the city..$ 15,275,600

Project No. 6.

Providing for a flow of 200,000 cubic feet per second by building detaining reservoirs on the Scioto above Dublin and on the Olentangy above Delaware to detain so much of the maximum flow that only three-quarters would have to be provided for through the city, one-quarter by the old channel around the Bend, and one-half through a new channel between McDowell Street and Gift Street. The rivers to be also improved above and below the city.....$ 13,616,900

Project No. 7.

Providing for a flow of 150,000 cubic feet per second by abandoning the old channel around the Bend

and cutting a new channel to take the total flow across the West Side between McDowell Street and Skidmore Street: also to improve the rivers above and below the city ..... $ 11,263,300

Project No. 8.

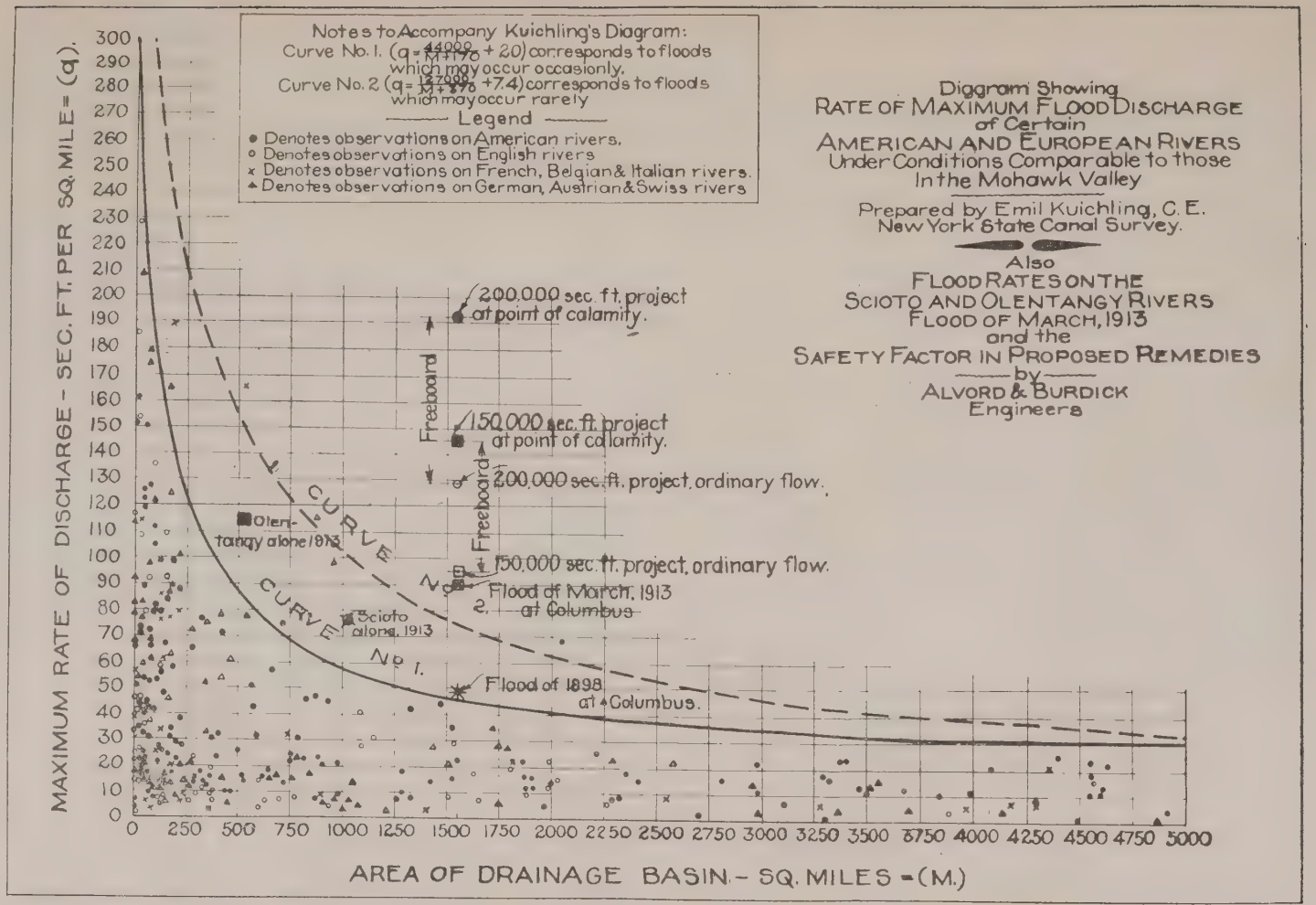
Providing for a flow of 150,000 cubic feet per second by using the old channel without material improvements around the Bend to carry one-third the flow and cutting a new channel across the West Side between McDowell and Gift Streets to take the other two-thirds of the flow ..... $ 10,120,600

Project No. 9.

Providing for a flow of 150,000 cubic feet per second by building detaining reservoirs above Dublin and Delaware to detain one-third of the flood and providing a new channel across the West Side to carry the other two-thirds and abandoning the present channel around the Bend. Also to improve the rivers above and below the city..... $ 11,308,000

Project No. 10.

Providing for a flow of 150,000 cubic feet per second by building detaining reservoirs above Dublin and above Delaware which will detain one-third the total flow and providing for the other two-thirds of the flood by enlarging the channel around the Bend but not with such substantial improvements as contemplated in Project No. 2. Also improving the rivers above and below the city ..... $ 11,259,700


Notes to Accompany Kuichling's Diagram:
Curve No. 1. (q = 44000/M+170 + 20) corresponds to floods which may occur occasionly.
Curve No. 2 (q = 127000/M+370 +7.4) corresponds to floods which may occur rarely
Legend
Denotes observations on American rivers.
Denotes observations on English rivers
Denotes observations on French, Belgian & Italian rivers.
Denotes observations on German, Austrian & Swiss rivers
Diggram Showing
RATE OF MAXIMUM FLOOD DISCHARGE
of Certain
AMERICAN AND EUROPEAN RIVERS
Under Conditions Comparable to those
In the Mohawk Valley
Prepared by Emil Kuichling, C. E.
New York State Canal Survey.
Also
FLOOD RATES ON THE
SCIOTO AND OLENTANGY RIVERS
FLOOD OF MARCH, 1913
and the
SAFETY FACTOR IN PROPOSED REMEDIES
by
ALVORD & BURDICK
Engineers
MAXIMUM RATE OF DISCHARGE - SEC. FT. PER SQ. MILE = (q).
AREA OF DRAINAGE BASIN - SQ. MILES = (M.)
200,000 sec. ft. project at point of calamity.
150,000 sec. ft. project at point of calamity.
200,000 sec. ft. project, ordinary flow.
150,000 sec. ft. project, ordinary flow.
Freeboard
Freeboard
CURVE No. 2
CURVE No. 1.
Olentangy alone 1913
Scioto alone, 1913
Flood of March, 1913 at Columbus
Flood of 1898 at Columbus.

PROJECT NO. 1.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET BY

DEEPENING AND WIDENING THE PRESENT RIVERS.

	Section "A" Mound to Sandusky	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto south of Mound	Totals
PreliminaryExpense 1%	$129,400	$6,500	$22,800	$14,100	$172,800
Land	4,133,000	64,800	310,800	530,400	5,038,800
Direct Damages	150,000				150,000
Temporary Bridges and Streets	78,000				78,000
Changes in Water Pipes	110,000	84,000			194,000
Changes in Sewers	38,000				38,000
Changes in Lighting	10,000				10,000
Excavation	4,160,000	375,000	1,180,000	622,000	6,337,000
Bridges	2,443,000	61,200	263,500		2,767,700
Walls	977,000				977,000
Dams and Weirs	433,000	20,000	416,500	90,000	959,500
Control Gates				11,200	11,200
Raising Streets and New Streets	410,900	40,000	113,700	107,100	671,700
Repairing levees				48,100	48,100
Administration by Commission 2%	258,900	12,800	45,700	28,200	345,700
Engineering & Superintending 6%	776,700	38,700	137,000	84,500	1,036,900
Loss of Interest dur.Constr. 3%	388,300	19,400	68,500	42,300	518,500
Contingencies & indirect damages 8%	1,035,400	51,600	182,700	112,700	1,382,400
	15,531,600	774,500	2,741,200	1,690,600	20,737,300
Changes in Railroads	390,000	229,200	113,000		732,200
Railroad Bridges	675,000	115,000	417,000		1,207,000
Changes in Street Railways	77,000	9,000	6,000		92,000
Changes in other Utilities	167,700	1,100	3,000	1,200	173,000
Add 20%, Detailed as above	261,900	70,900	107,800	200	440,800
	1,571,600	425,200	648,800	1,400	2,645,000
GRAND TOTALS	$17,103,200	$1,199,700	$3,388,000	$1,692,000	$23,382,300

PHYSICAL DATA AND SUMMARY OF COST BY ITEMS
OF THE TEN INVESTIGATED PROJECTS FOR FLOOD PROTECTION
AT COLUMBUS, OHIO.

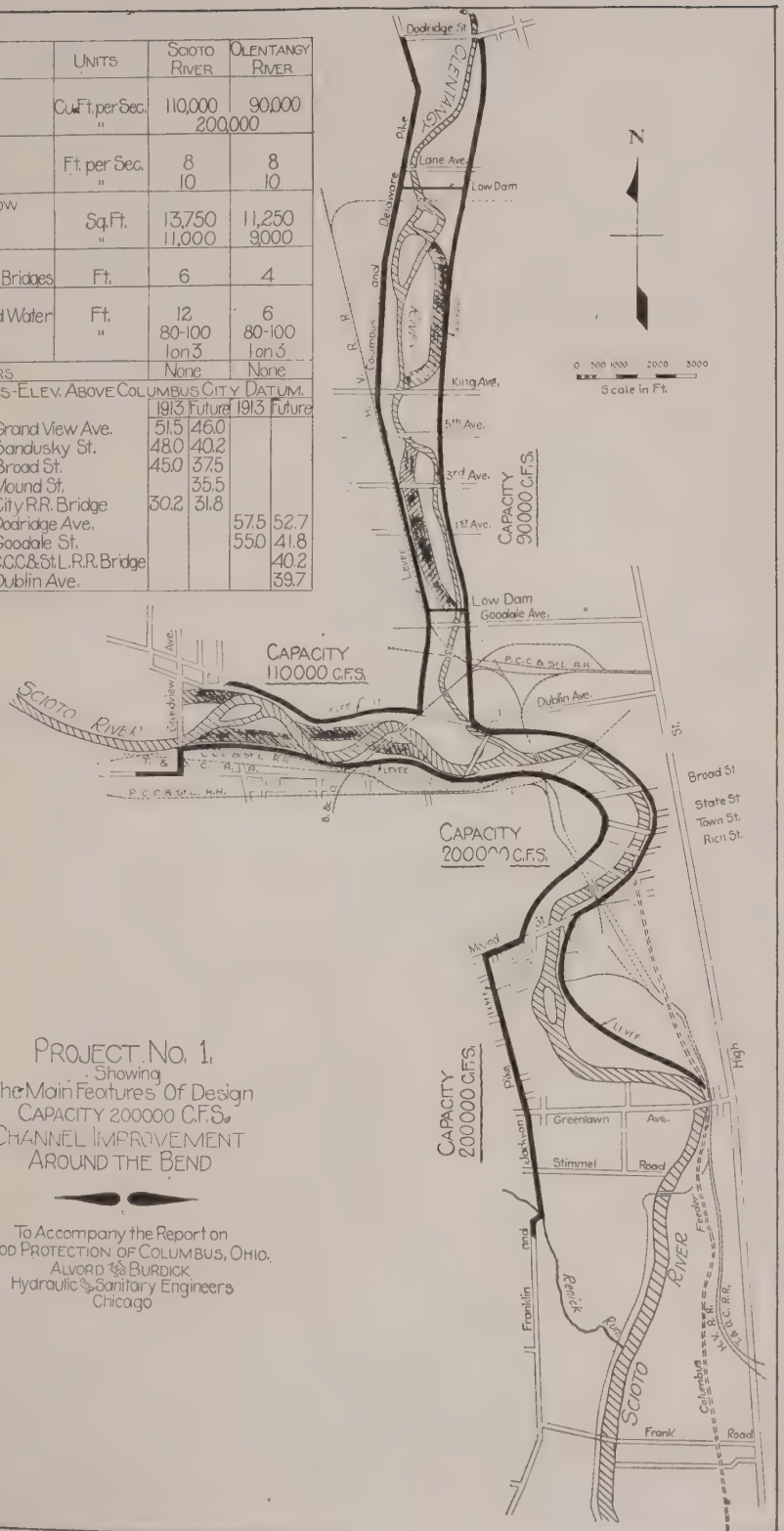
		Units	Proj.No. 1	Proj.No.2	Proj.No.3	Proj.No. 4	Proj.No.5	Proj.No.6	Proj.No.7	Proj.No.8	Proj.NO.9	Proj.No.10
Total Flood Capacity		C.F.S.	200,000	200,000	200,000	200,000	200,000	200,000	150,000	150,000	150,000	150,000
Capacity,Scioto No.of Sandusky	Sec.D	"	110,000	110,000	10,000	110,000	110,000	85,500	85,500	85,500	57,000	57,000
" " Mound to Sandusky	" A	"	200,000	100,000	100,000	- -	50,000	50,000	- -	50,000	- -	100,000
" " S.of Mound	" F	"	200,000	200,000	100,000 200,000	200,000	200,000	150,000	150,000	150,000	100,000	100,000
" Olentangy	" E	"	80,000	80,000	80,000	80,000	80,000	64,500	64,500	64,500	43,000	43,000
" Gift St.Cut-off	" B	"	-------	100,000	- -	200,000	150,000	100,000	150,000	100,000	100,000	- -
" Asylum Cut-off	" C	"	-------	----	100,000	- -	- -	- -	- -	- -	- -	- -
Reservoirs to detain			-------	---	---	- -	- -	50,000	- -	- -	50,000	50,000
Preliminary Expense	1%	Dollars	172,800	165,000	152,400	112,400	113,100	100,900	80,800	71,800	84,900	83,800
Land		"	5,038,800	3,993,800	3,232,700	3,814,300	3,107,600	3,761,500	3,088,000	2,857,500	3,813,100	3,039,800
Direct Damages		"	150,000	211,200	200,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Temporary Streets and Bridges		"	78,000	136,000	152,000	52,000	80,000	80,000	46,000	80,000	46,000	50,000
Changes in Water Lines		"	194,000	193,600	118,300	140,400	148,400	12,000	24,400	24,400	12,000	13,200
Changes in Sewers		"	38,000	124,200	122,400	186,400	86,400	86,400	186,400	86,400	186,400	1,500
Changes in Street Lighting		"	10,000	12,500	12,100	7,000	5,900	5,900	5,900	5,900	4,900	2,200
Excavation		"	6,337,000	5,073,000	5,928,000	3,542,000	3,479,500	1,841,500	2,416,000	1,841,500	994,000	1,394,000
Street Bridges		"	2,767,700	3,009,700	2,615,700	1,828,700	2,655,700	1,445,200	1,289,200	1,493,200	1,199,000	1,468,000
Walls		"	977,000	1,393,800	943,000	- -	- -	- -	- -	- -	- -	72,000
Dams,weirs,slope paving & control gates		"	970,700	1,263,300	913,000	970,700	970,700	2,367,200	493,200	493,200	2,119,000	209,200
Raising streets and new streets		"	671,700	848,100	871,500	583,400	472,200	384,500	418,500	384,500	248,200	167,500
Repairing levees and buildings		"	48,100	48,100	113,100	48,100	48,100	48,100	48,100	48,100	4,000	4,000
Parks		"	- -	200,000	- -	200,000	200,000	- -	- -	- -	- -	- -
Administration by Commission	2%	"	345,700	329,900	304,800	224,700	228,400	201,800	161,500	143,800	169,700	167,300
Engineering & Superintending	6%	"	1,036,800	989,800	913,700	673,900	678,800	604,900	484,500	430,400	509,300	501,800
Interest Lost during Construction	3%	"	518,500	495,000	457,000	337,100	339,500	302,400	242,300	215,300	254,500	250,900
Contingencies & Indirect Damages	8%	"	1,382,400	1,319,700	1,218,500	898,500	905,200	806,600	646,000	574,000	678,900	690,000
Total		"	20,737,300	19,786,500	18,278,000	13,478,600	13,236,500	12,098,800	9,690,800	8,609,800	10,183,900	10,014,800
Changes in Railroads		"	732,200	789,800	660,100	412,200	412,200	229,000	229,000	229,000	158,000	219,500
Railroad Bridges		"	1,207,000	1,169,000	1,398,000	977,000	1,120,000	886,000	926,000	880,000	635,000	755,000
Changes in Street Railways		"	92,000	111,300	115,900	91,000	74,400	63,800	65,400	63,800	60,200	22,800
Changes in other Public Utilities		"	173,000	193,500	147,700	190,700	92,600	86,200	90,000	86,200	83,500	40,100
Contingencies 20%,Detailed as above		"	440,800	440,700	464,200	333,200	339,900	253,000	282,100	251,800	187,400	207,500
Total		"	2,646,000	2,644,300	2,785,900	2,004,100	2,039,100	1,518,000	1,572,500	1,510,800	1,124,100	1,244,900
GRAND TOTALS		"	23,382,300	22,440,800	21,063,900	15,483,700	15,275,600	13,616,800	11,263,300	10,120,600	11,308,000	11,259,700

PHYSICAL DATA AND SUMMARY OF COST BY SECTIONS
OF THE TEN INVESTIGATED PROJECTS FOR FLOOD PROTECTION
AT COLUMBUS, OHIO.

Proj. No.		Units	Section "A" *	Section "B"*	Section "C"*	Section "D"*	Section "E" *	Section "F" *	Reservoirs *	Totals
1	Flood Flow	Sec.Ft.	200,000	--	--	110,000	90,000	200,000	--	200,000
	City & County	$	15,631,600	--	--	774,500	2,741,200	1,690,800	--	20,737,300
	Public Utilities	$	1,671,600	--	--	425,200	646,800	1,400	--	2,645,000
	Total	$	17,103,200	--	--	1,199,700	3,388,000	1,892,000	--	23,382,300
2	Flood Flow	Sec.Ft.	100,000	100,000	--	Same	Same	Same	--	200,000
	City & County	$	8,522,400	6,067,800	--	as	as	as	--	19,796,500
	Public Utilities	$	1,137,500	433,400	--	Proj.No.1	Proj.No.1	Proj.No.1	--	2,644,300
	Total	$	9,659,900	6,501,200	--				--	22,440,800
3	Flood Flow	Sec.Ft.	100,000	--	100,000	10,000	Same		--	200,000
	City & County	$	7,627,000	--	6,648,400	102,600	as	1,160,800	--	18,278,000
	Public Utilities	$	1,137,500	--	904,400	95,800	Proj.No.1	1,400	--	2,785,900
	Total	$	8,764,500	--	7,550,800	198,400		1,162,200	--	21,063,900
4	Flood Flow	Sec.Ft.	--	200,000	--	Same	Same	Same	--	200,000
	City & County	$	1,329,600	6,943,700	--	as	as	as	--	13,479,800
	Public Utilities	$	48,400	882,300	--	Proj.No.1	Proj.No.1	Proj.No.1	--	2,004,100
	Total	$	1,378,000	7,826,000	--				--	15,483,700
5	Flood Flow	Sec.Ft.	50,000	150,000	--	Same	Same	Same	--	200,000
	City & County	$	2,150,700	5,879,500	--	as	as	as	--	13,236,500
	Public Utilities	$	220,000	745,700	--	Proj.No.1	Proj.No. 1	Proj.No. 1	--	2,039,100
	Total	$	2,370,700	6,815,200	--				--	15,275,600
6	Flood Flow	Sec.Ft.	50,000	100,000	--	85,500	64,500	150,000	50,000	200,000
	City, & County & State	$	1,377,600	4,054,100	--	563,700	851,300	1,690,600	3,561,600	12,098,900
	Public Utilities	$	220,000	559,200	--	217,200	520,200	1,400	--	1,518,000
	Total	$	1,597,600	4,613,300		780,900	1,371,500	1,692,000	3,561,600	13,816,900
7	Flood Flow	Sec.Ft.	--	150,000	--	Same	Same	Same	--	150,000
	City,& County	$	1,021,100	5,564,100	--	as	as	as	--	9,690,800
	Public Utilities	$	118,000	715,700	--	Proj.No.6	Proj.No.6	Proj.No.6	--	1,572,500
	Total	$	1,139,100	6,279,800	--				--	11,263,300
8	Flood Flow	Sec.Ft.	50,000	100,000	--	Same	Same	Same	--	150,000
	City & County	$	1,436,200	4,089,000	--	as	as	as	--	8,609,800
	Public Utilities	$	212,800	559,200	--	Proj.No.6	Proj.No.6	Proj.No.6	--	1,510,800
	Total	$	1,648,000	4,628,200	--				--	10,120,600
9	Flood Flow	Sec.Ft.	--	100,000	--	57,000	43,000	100,000	50,000	150,000
	City,County & State	$	770,900	4,054,100	--	122,500	746,100	928,700	3,561,600	10,183,900
	Public Utilities	$	48,400	559,200	--	49,200	467,300	--	--	1,124,100
	Total	$	819,300	4,613,300	--	171,700	1,213,400	928,700	3,561,600	11,308,000
10	Flood Flow	Sec.Ft.	100,000	--	--	Same	Same	Same	Same	150,000
	City,County & State	$	4,656,000	--	--	as	as	as	as	10,014,800
	Public Utilities	$	728,400	--	--	Proj.No.9	Proj.No.9	Proj.No.9	Proj.No.9	1,244,900
	Total	$	5,384,400	--	--					11,259,700

	Units	Scioto River	Olentangy River
Flood Flow Volume			
Each River	Cu. Ft. per Sec.	110,000	90,000
Total	"	200,000	
Velocity of Flow			
Between Bridges	Ft. per Sec.	8	8
Under Bridges	"	10	10
Cross Section of Flow			
Between Bridges	Sq. Ft.	13,750	11,250
Under Bridges	"	11,000	9,000
Clear Height			
Flood Water Up to Bridges	Ft.	6	4
Levees			
Height Above Flood Water	Ft.	12	6
Top Width	"	80-100	80-100
Side Slopes		1 on 3	1 on 3
Detaining Reservoirs		None	None

Flood Water Levels-Elev. Above Columbus City Datum.		1913	Future	1913	Future
Scioto River	Grand View Ave.	51.5	46.0		
"	Sandusky St.	48.0	40.2		
"	Broad St.	45.0	37.5		
"	Mound St.		35.5		
"	City R.R. Bridge	30.2	31.8		
Olentangy River-Dodridge Ave.				57.5	52.7
"	Goodale St.			55.0	41.8
"	C.C.C.&St.L.R.R.Bridge				40.2
"	Dublin Ave.				39.7



PROJECT No. 1.

Showing
The Main Features Of Design
CAPACITY 200000 C.F.S.
CHANNEL IMPROVEMENT
AROUND THE BEND

To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK
Hydraulic & Sanitary Engineers
Chicago

891.

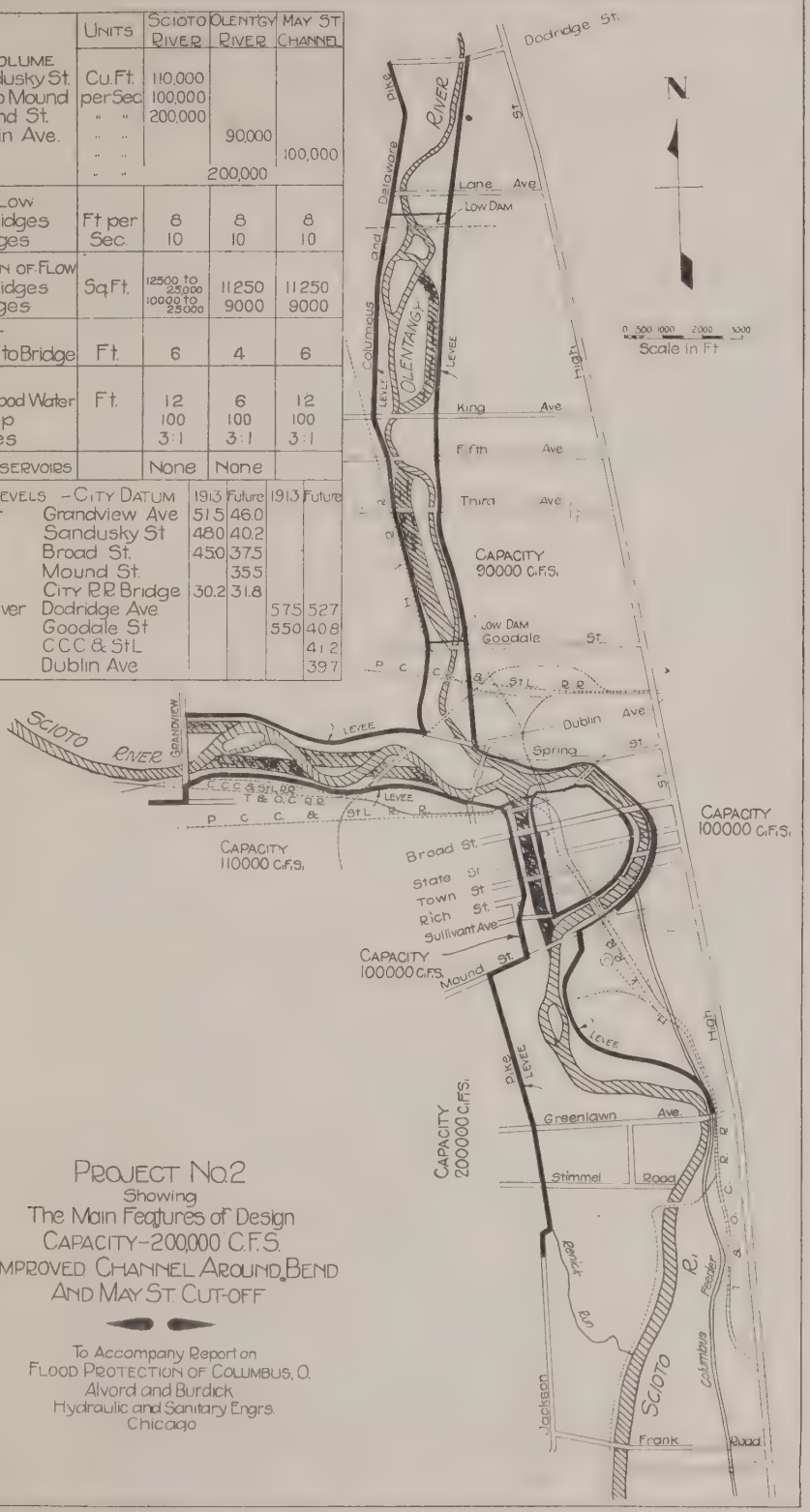
PROJECT NO. 2.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET PER SECOND BY IMPROVING PRESENT RIVERS AND CREATING AN AUXILIARY CHANNEL ACROSS THE WEST SIDE BETWEEN MCDOWELL AND GIFT STREETS.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-Off	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto south of Mound	Totals
Preliminary Expense 1%	$71,000:	$50,600:	$6,500:	$22,800:	$14,100	$165,000
Land	1,316,700:	1,771,300:	64,600:	310,800:	530,400	3,893,800
Direct Damages	150,000:	61,200:				211,200
Temporary Bridges and Streets	72,000:	54,000:				136,000
Changes in Water Pipes	95,700:	13,900:	84,000:			193,600
Changes in Sewers	37,800:	86,400:				124,200
Changes in Lighting	8,900:	3,600:				12,500
Excavation	1,742,000:	1,154,000:	375,000:	1,180,000:	822,000	5,073,000
Bridges	1,935,000:	750,000:	61,200:	263,500:		3,009,700
Walls	929,000:	464,600:				1,393,600
Dams and Weirs	433,100:	292,500:	20,000:	416,500:	90,000	1,252,100
Control Gates					11,200	11,200
Raising streets and New Streets	381,700:	205,000:	40,600:	113,700:	107,100	848,100
Repairing levees					48,100	48,100
Parking,		200,000:				200,000
Administration by Commission 2%	142,000:	101,100:	12,900:	45,700:	28,200	329,900
Engineering & superintending 6%	426,200:	303,400:	38,700:	137,000:	84,500	989,800
Loss of Interest during const. 3%	213,100:	151,700:	19,400:	68,500:	42,300	495,000
Contin.& indirect damages 8%	568,200:	404,500:	51,600:	182,700:	112,700	1,319,700
	8,522,400:	6,087,800:	774,500:	2,741,200:	1,690,600	19,796,500
Changes in Railroads	387,600:	[illegible]:	229,200:	113,000:		729,800
Railroad Bridges	433,000:	204,000:	115,000:	417,000:		1,169,000
Changes in Street Railways	52,500:	43,800:	9,000:	6,000:		111,300
Changes in Other Utilities	74,800:	113,400:	1,100:	3,000:	1,200	193,500
Add 20%, Engr. Int. Cont. etc. as detailed above	189,600:	72,200:	70,900:	107,800:	200	440,700
	1,137,500:	433,400:	425,200:	648,800:	1,400	2,644,300
GRAND TOTALS	$9,659,900	$6,501,200	$1,199,700	$3,388,000	$1,692,000	$22,440,800

	Units	Scioto River	Olentgy River	May St Channel
Flood Flow Volume				
Above Sandusky St.	Cu. Ft.	110,000		
Sandusky to Mound	per Sec.	100,000		
Below Mound St.	" "	200,000		
Above Dublin Ave.	" "		90,000	
May St.	" "			100,000
Total Volume	" "		200,000	
Velocity of Flow				
Between Bridges	Ft per	8	8	8
Under Bridges	Sec.	10	10	10
Cross Section of Flow				
Between Bridges	Sq. Ft.	12500 to 25,000	11250	11250
Under Bridges		10000 to 25000	9000	9000
Clear Height				
Flood Water to Bridge	Ft.	6	4	6
Levees				
Ht. above Flood Water	Ft.	12	6	12
Width on Top		100	100	100
Side Slopes		3:1	3:1	3:1
Detaining Reservoirs		None	None	

Flood Water Levels – City Datum		1913	Future	1913	Future
Scioto River	Grandview Ave	51.5	46.0		
	Sandusky St	48.0	40.2		
	Broad St.	45.0	37.5		
	Mound St.		35.5		
	City R.R. Bridge	30.2	31.8		
Olentangy River	Dodridge Ave			57.5	52.7
	Goodale St			55.0	40.8
	C.C.C. & St.L.				41.2
	Dublin Ave				39.7



PROJECT NO. 2

Showing
The Main Features of Design
CAPACITY – 200,000 C.F.S.
IMPROVED CHANNEL AROUND BEND
AND MAY ST. CUT-OFF

To Accompany Report on
FLOOD PROTECTION OF COLUMBUS, O.
Alvord and Burdick
Hydraulic and Sanitary Engrs.
Chicago

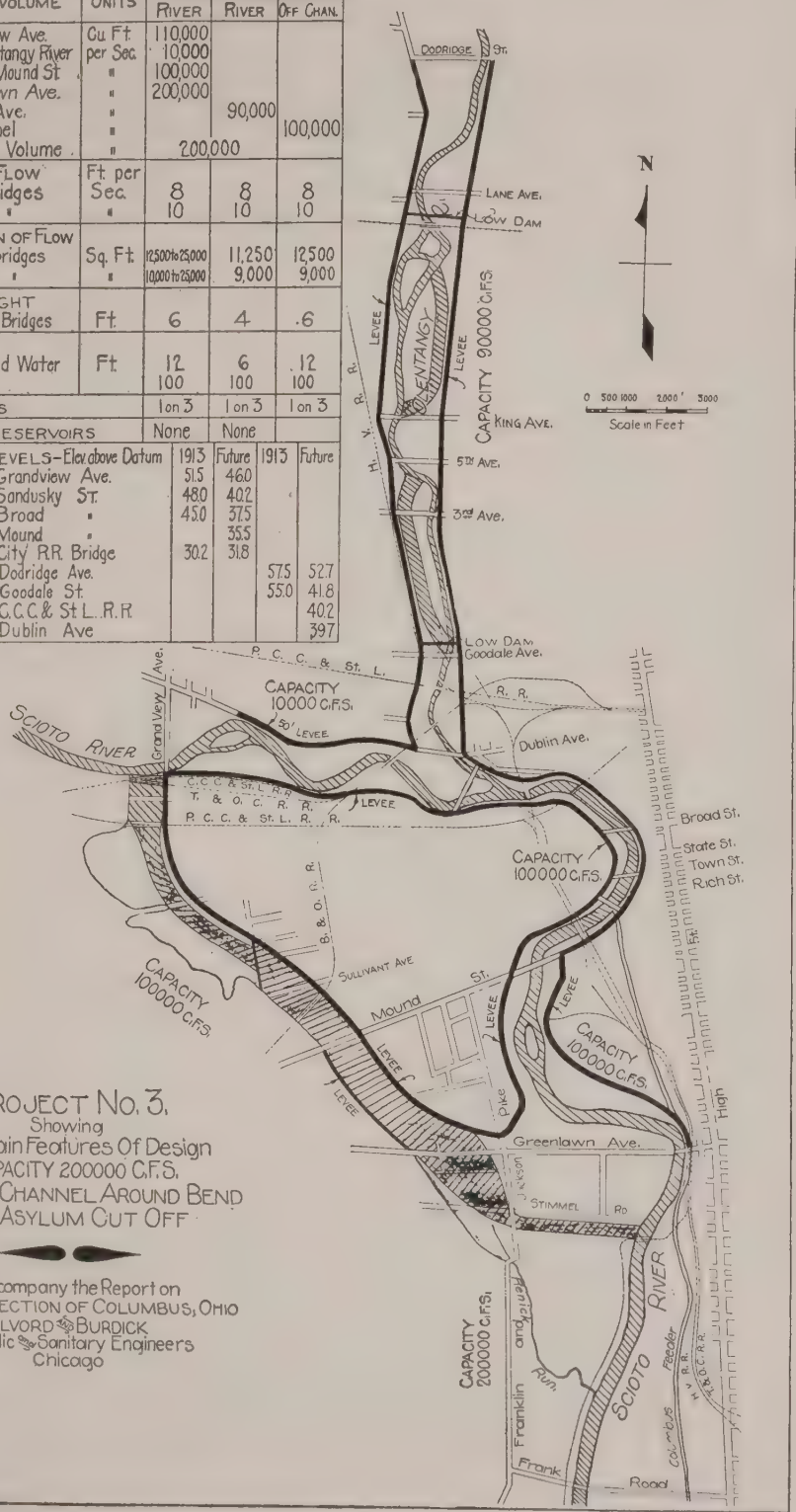
PROJECT NO. 3.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET PER SECOND BY IMPROVING THE PRESENT RIVERS AND PROVIDING AN AUXILIARY CHANNEL ACROSS THE ASYLUM GROUND FROM A POINT WEST OF GRANDVIEW AVENUE BRIDGE TO THE SCIOTO RIVER AT STIMMEL ROAD.

	Section "A" Mound St. to Sandusky	Section "C" Asylum Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto south of Mound	Total
Preliminary Expense 1%	$63,600	$55,400	$900	$22,800	$9,700	$152,400
Land	1,316,700	1,097,900		310,800	507,300	3,232,700
Direct Damage	150,000	50,000				200,000
Improvements		75,000				75,000
Temporary Bridges and Streets	72,000	80,000				152,000
Changes in Water Pipes	95,700	22,600				118,300
Changes in Sewers	37,800	84,600				122,400
Changes in Lighting	8,900	3,200				12,100
Excavation	1,742,000	2,740,000		1,180,000	266,000	5,928,000
Bridges	1,354,000	968,200	30,000	263,500		2,615,700
Walls	929,000	14,000				943,000
Dams, weirs & slope paving	268,000	119,800	18,700	416,500	90,000	913,000
Control Gates						
Raising Streets and New Streets	381,700	283,300	36,800	113,700	56,000	871,500
Repairing Levees					48,100	48,100
Administration by Commission 2%	127,100	110,800	1,700	45,700	19,300	304,600
Engineering & Superintending 6%	381,300	332,300	5,100	137,000	58,000	913,700
Loss of Interest dur.Constr. 3%	190,700	166,200	2,600	68,500	29,000	457,000
Contin.& indirect damages 8%	508,500	443,100	6,800	182,700	77,400	1,218,500
	7,827,000	6,646,400	102,600	2,741,200	1,160,800	18,278,000
Changes in Railroads	387,600	89,500	70,000	113,000		660,100
Railroad Bridges	433,000	548,000		417,000		1,398,000
Changes in Street Railways	52,500	48,600	8,800	6,000		115,900
Changes in other Utilities	74,800	67,700	1,000	3,000	1,200	147,700
Add 20%	189,600	150,600	16,000	107,800	200	464,200
	1,137,500	904,400	95,800	646,800	1,400	2,785,900
GRAND TOTALS	$8,764,500	$7,550,800	$198,400	$3,388,000	$1,162,200	21,063,900

Flood Flow Volume	Units	Scioto River	Olentangy River	Asylum Cut Off Chan.
Above Grandview Ave.	Cu Ft	110,000		
Grandview to Olentangy River	per Sec.	10,000		
Olentangy River to Mound St.	"	100,000		
Below Greenlawn Ave.	"	200,000		
Above Dublin Ave.	"		90,000	
Cut Off Channel	"			100,000
Total Volume	"	200,000		
Velocity of Flow Between Bridges	Ft. per Sec.	8	8	8
Under "	"	10	10	10
Cross Section of Flow Between Bridges	Sq. Ft.	12,500 to 25,000	11,250	12,500
Under "	"	10,000 to 25,000	9,000	9,000
Clear Height Flood Water to Bridges	Ft.	6	4	.6
Levees Height above Flood Water	Ft.	12	6	12
Top Width		100	100	100
Side Slopes		1 on 3	1 on 3	1 on 3
Detaining Reservoirs		None	None	

Flood Water Levels – Elev. above Datum	1913	Future	1913	Future
Scioto River – Grandview Ave.	51.5	46.0		
" Sandusky St.	48.0	40.2		
" Broad "	45.0	37.5		
" Mound "		35.5		
" City R.R. Bridge	30.2	31.8		
Olentangy River – Dodridge Ave.			57.5	52.7
" Goodale St.			55.0	41.8
" C.C.C. & St L. R.R.				40.2
" Dublin Ave				39.7



Project No. 3.

Showing
The Main Features Of Design
Capacity 200000 C.F.S.
Improved Channel Around Bend
and Asylum Cut Off

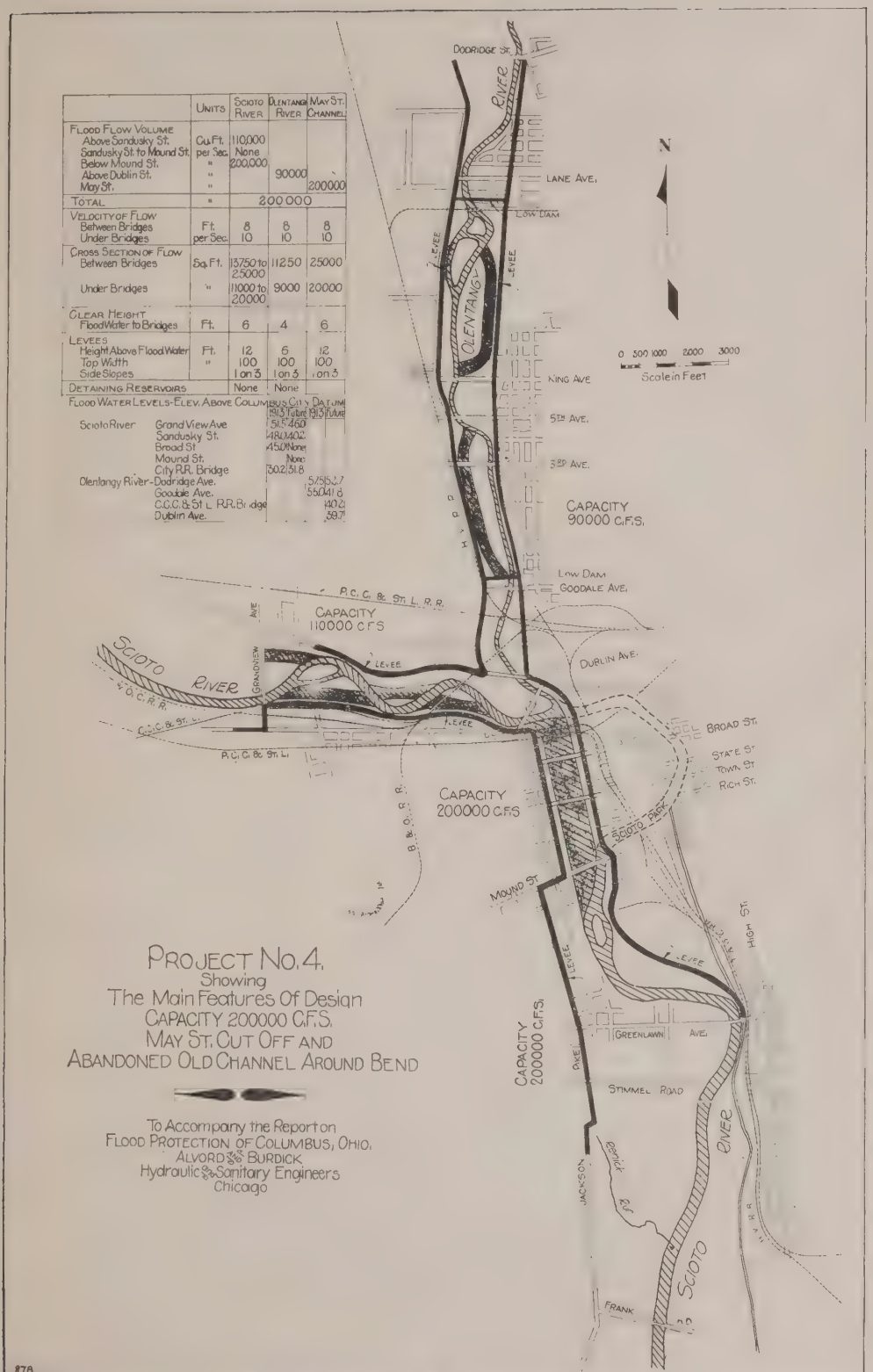
To Accompany the Report on
Flood Protection of Columbus, Ohio
Alvord & Burdick
Hydraulic & Sanitary Engineers
Chicago

880.

PROJECT NO. 4.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET PER SECOND BY OPENING A NEW CHANNEL ACROSS THE WEST SIDE BETWEEN MCDOWELL AND GRUB STREET AND ABANDONING AND FILLING UP THE PRESENT BED OF THE RIVER AROUND THE BEND.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto south of Mound	Totals
Preliminary Expense 1%	$11,100:	$57,900:	$6,500:	$22,800:	$14,100:	$112,400
Land	:	2,708,500:	64,600:	310,800:	530,400:	3,614,300
Direct Damages	:	60,000:	:	:	:	60,000
Temporary Bridges & Streets	4,000:	48,000:	:	:	:	52,000
Changes in Water Pipes	33,500:	22,900:	84,000:	:	:	140,400
Changes in Sewers	100,000:	86,400:	:	:	:	186,400
Changes in Lighting	1,000:	6,000:	:	:	:	7,000
Excavation	[illegible]:	1,365,000:	375,000:	1,180,000:	622,000:	3,542,000
Bridges	496,000:	1,008,000:	61,200:	263,500:	:	1,828,700
Wells	:	:	:	:	:	
Dams and Weirs	433,000:	:	20,000:	416,500:	90,000:	959,500
Control Gates	:	:	:	:	11,200:	11,200
Raising Streets & New Streets	40,400:	281,600:	40,600:	113,700:	107,100:	583,400
Repairing Levees	:	:	:	:	48,100:	48,100
Parking	:	200,000:	:	:	:	200,000
Administration By Commission 2%	22,200:	116,700:	12,900:	45,700:	28,200:	224,700
Engineering & Superintending 6%	66,500:	347,200:	38,700:	137,000:	84,500:	673,900
Loss of Interest dur.Constr. 3%	33,300:	173,800:	19,400:	68,500:	42,300:	337,100
Contingencies & indirect damages 8%	88,600:	462,900:	51,600:	182,700:	112,700:	898,500
	$1,329,600:	6,943,700:	774,500:	2,741,200:	1,690,600:	13,479,600
Changes in Railroads	:	70,000:	228,200:	113,000:	:	412,200
Railroad Bridges	:	445,000:	115,000:	417,000:	:	977,000
Changes in Street Railways	10,800:	65,200:	9,000:	6,000:	:	91,000
Changes in other Utilities	28,500:	155,900:	1,100:	3,000:	1,200:	190,700
Add 20%, Detailed as above	8,100:	148,200:	70,900:	107,800:	200:	333,200
	48,400:	882,300:	425,200:	646,800:	1,400:	2,004,100
GRAND TOTALS	$1,378,000:	7,826,000:	1,199,700:	3,388,000:	1,692,000:	15,483,700



	Units	Scioto River	Olentangy River	May St. Channel
Flood Flow Volume				
Above Sandusky St.	Cu. Ft.	110000		
Sandusky St. to Mound St.	per Sec.	None		
Below Mound St.	"	200000		
Above Dublin St.	"		90000	
May St.	"			200000
TOTAL	"	200000		
Velocity of Flow				
Between Bridges	Ft.	8	8	8
Under Bridges	per Sec.	10	10	10
Cross Section of Flow				
Between Bridges	Sq. Ft.	13750 to 25000	11250	25000
Under Bridges	"	11000 to 20000	9000	20000
Clear Height				
Flood Water to Bridges	Ft.	6	4	6
Levees				
Height Above Flood Water	Ft.	12	6	12
Top Width	"	100	100	100
Side Slopes		1 on 3	1 on 3	1 on 3
Detaining Reservoirs		None	None	

Flood Water Levels-Elev. Above Columbus City Datum

		1913	Future
Scioto River	Grand View Ave	515	460
	Sandusky St.	480	402
	Broad St	450	None
	Mound St.	None	
	City R.R. Bridge	502	518
Olentangy River	Dodridge Ave.	575	527
	Goodale Ave.	560	418
	C.C.C. & St L. R.R. Bridge		402
	Dublin Ave.		587

PROJECT No. 4.

Showing
The Main Features Of Design
CAPACITY 200000 C.F.S.
MAY ST. CUT OFF AND
ABANDONED OLD CHANNEL AROUND BEND

To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK
Hydraulic & Sanitary Engineers
Chicago

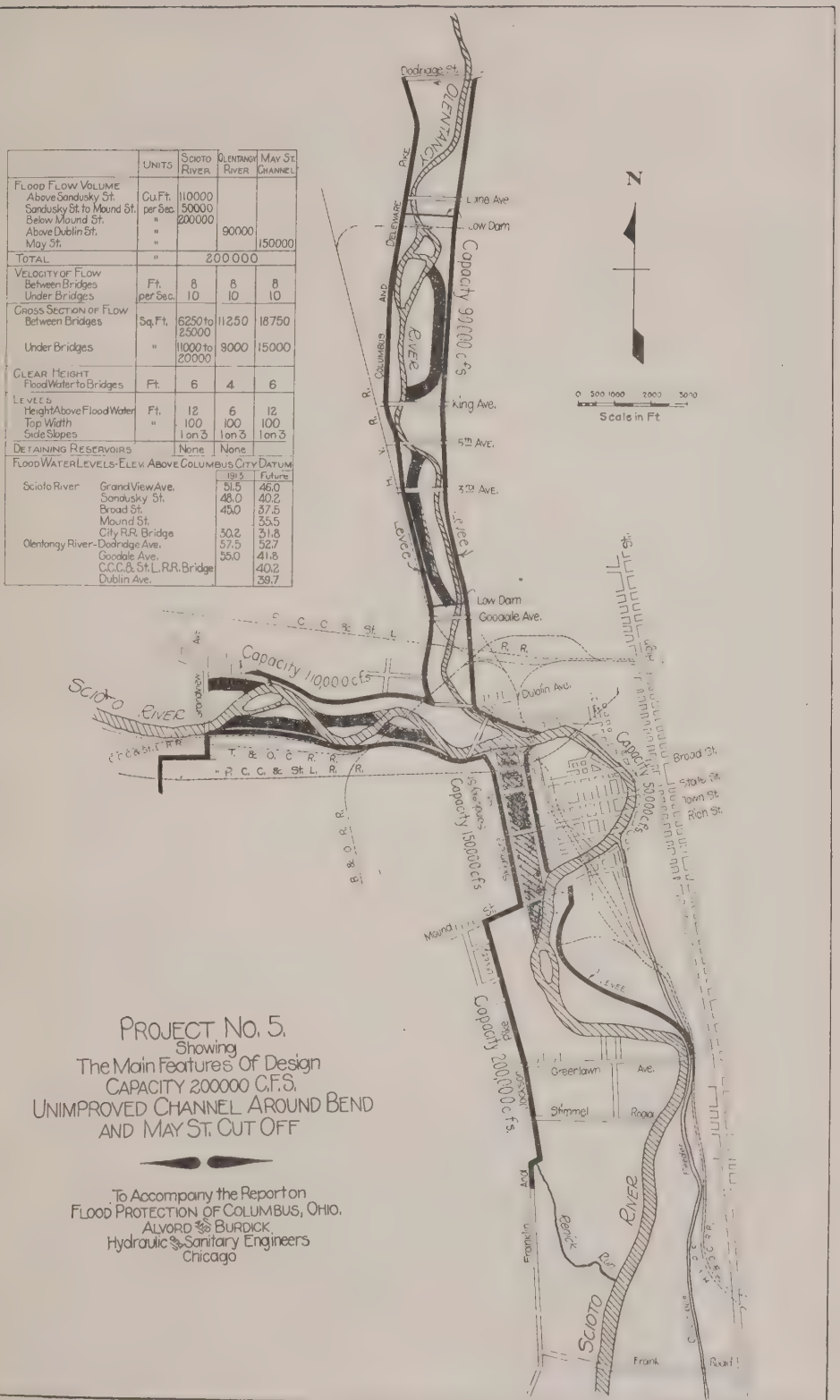
878.

PROJECT NO. 5.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET FLOW BY

PASSING ONE-QUARTER IN PRESENT CHANNEL AND THREE-QUARTERS IN MAY ST. CUT-OFF.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy River	Section "F" Scioto south of Mound	Totals
Preliminary Expense 1%	$17,900	$49,000	$6,500	$22,800	$14,100	$113,100
Land		2,201,800	64,600	310,800	530,400	3,107,600
Direct Damages		80,000				80,000
Temporary Bridges and Streets	38,000	42,000				80,000
Changes in Water Pipes	53,400	12,000	84,000			149,400
Changes in Sewers		86,400				86,400
Changes in Lighting	2,000	3,900				5,900
Excavation		1,302,600	375,000	1,180,000	622,000	3,479,600
Bridges	1,195,000	851,000	81,200	263,500		2,855,700
Walls						
Dams and Weirs	433,000		20,000	416,500	90,000	959,500
Control Gates					11,200	11,200
Raising Streets and new streets	70,900	139,900	40,600	113,700	107,100	472,200
Repairing Levees					48,100	48,100
Parking		200,000				200,000
Administration by Commission 2%	35,900	98,000	12,800	45,700	28,200	226,400
Engineering & Superintending 6%	107,500	294,000	38,700	137,000	84,600	678,800
Loss of Interest dur.constr. 3%	53,700	147,000	19,400	68,500	42,300	339,500
Contingencies & indirect damages 8%	143,400	392,000	51,600	182,700	112,700	905,200
	2,150,700	5,879,500	774,500	2,741,200	1,690,600	13,238,500
Changes in Railroads		70,000	229,200	113,000		412,200
Railroad Bridges	143,000	445,000	115,000	417,000		1,120,000
Changes in Street Railways	10,800	48,600	9,000	6,000		74,400
Changes in other Utilities	29,500	57,800	1,100	3,000	1,200	92,600
Add 20%, Detailed as above	36,700	124,300	70,900	107,800	200	339,900
	220,000	745,700	425,200	646,800	1,400	2,039,100
GRAND TOTALS	$2,370,700	$6,615,200	$1,199,700	$3,388,000	$1,692,000	$15,275,600



	Units	Scioto River	Olentangy River	May St. Channel
Flood Flow Volume				
Above Sandusky St.	Cu. Ft. per Sec.	110000		
Sandusky St. to Mound St.	"	50000		
Below Mound St.	"	200000		
Above Dublin St.	"		90000	
May St.	"			150000
Total	"	200000		
Velocity of Flow				
Between Bridges	Ft. per Sec.	8	8	8
Under Bridges		10	10	10
Cross Section of Flow				
Between Bridges	Sq. Ft.	6250 to 25000	11250	18750
Under Bridges	"	11000 to 20000	9000	15000
Clear Height				
Flood Water to Bridges	Ft.	6	4	6
Levees				
Height Above Flood Water	Ft.	12	6	12
Top Width	"	100	100	100
Side Slopes		1 on 3	1 on 3	1 on 3
Detaining Reservoirs		None	None	

Flood Water Levels - Elev. Above Columbus City Datum		1913	Future
Scioto River	Grand View Ave.	51.5	46.0
	Sandusky St.	48.0	40.2
	Broad St.	45.0	37.5
	Mound St.		35.5
	City R.R. Bridge	30.2	31.8
Olentangy River -	Dodridge Ave.	57.5	52.7
	Goodale Ave.	55.0	41.8
	C.C.C.& St.L.R.R. Bridge		40.2
	Dublin Ave.		39.7

PROJECT NO. 5.

Showing
The Main Features Of Design
CAPACITY 200000 C.F.S.
UNIMPROVED CHANNEL AROUND BEND
AND MAY ST. CUT OFF

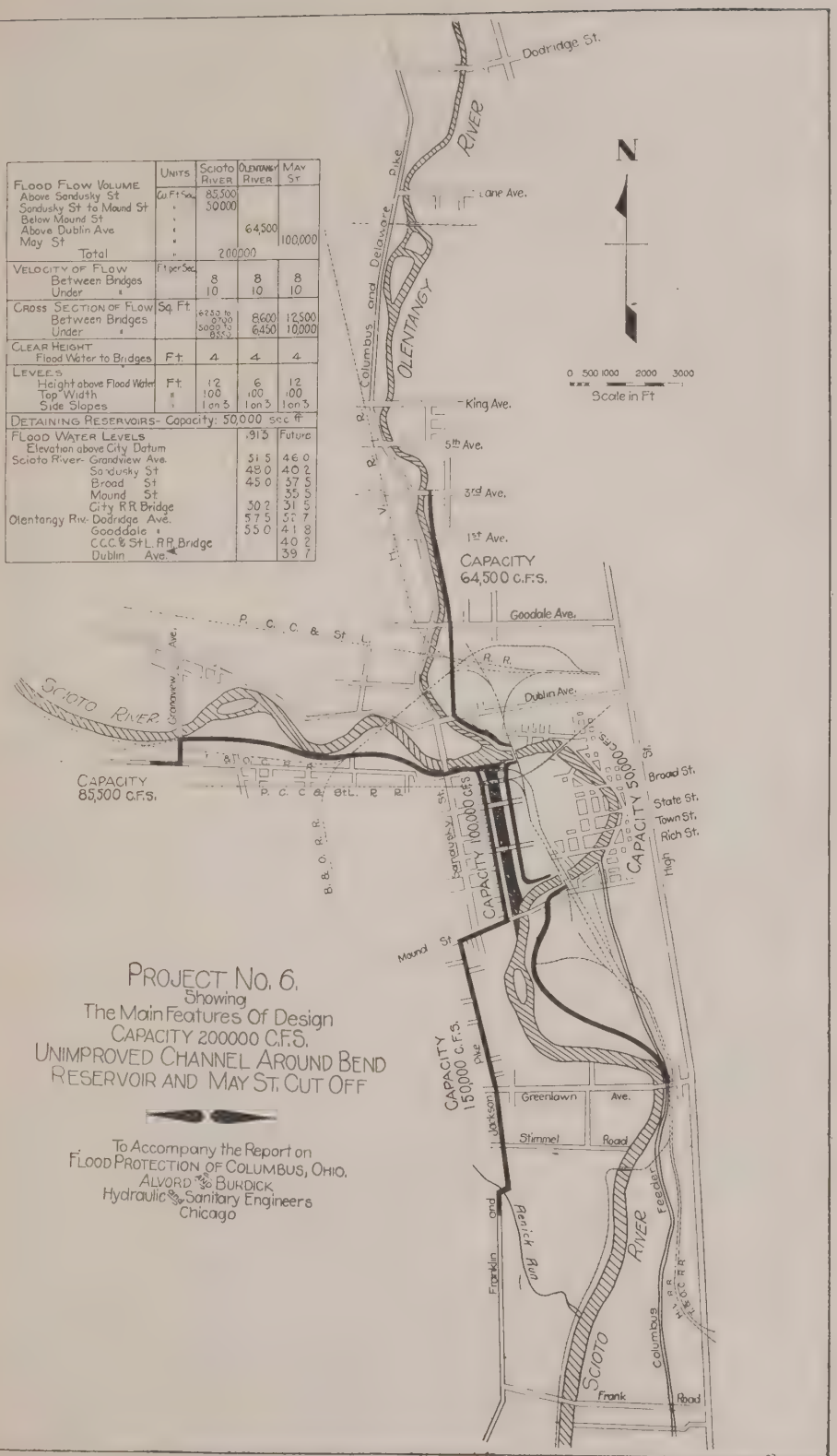
To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK,
Hydraulic & Sanitary Engineers
Chicago

872.

PROJECT NO. 6.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET PER SECOND BY BUILDING RESERVOIRS AT DUBLIN AND DELAWARE TO DETAIN 50,000 CUBIC FEET PER SECOND AND BUILDING A NEW CHANNEL BETWEEN MCDOWELL AND GIFT STREETS TO TAKE 100,000 CUBIC FEET PER SECOND AND ALLOWING THE AROUND THE BEND TO TAKE 50,000 CUBIC FEET PER SECOND.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto southof Mound	Reser-voirs	Totals
Preliminary Exp.1%	$11,500	$33,800	$4,700	$7,100	$14,100	$29,700	$100,900
Land		1,771,300	45,000	310,800	530,400	1,094,000	3,751,500
Direct Damages		60,000					60,000
Temp.Bridges & Streets	38,000	42,000					80,000
Chgs.in Water pipes		12,000					12,000
Chgs.in sewers		86,400					86,400
Chgs.in lighting	2,000	3,900					5,900
Excavation		728,000	389,000	102,500	622,000		1,841,500
Bridges	731,000	544,000	4,200	166,000			1,445,200
Dams and weirs	308,000		20,000	66,000	90,000	1,874,000	2,358,000
Control Gates					11,200		11,200
Raising Streets & New Streets	70,900	130,800	11,500	64,200	107,100		384,500
Repairing Levees					48,100		48,100
Administration by Commission 2%	23,000	67,600	9,400	14,200	28,200	59,400	201,800
Engr.& Supt. 6%	68,800	202,700	28,200	42,500	84,500	178,100	604,900
Loss of Int.dur. construction 3%	34,400	101,300	14,100	21,300	42,300	89,000	302,400
Cont.and indirect damages 8%	91,900	270,300	37,600	56,700	112,700	237,400	806,600
	1,377,600	4,054,100	563,700	851,300	1,690,600	3,561,600	12,098,900
Chgs.in Railroads		45,000	71,000	113,000			229,000
Railroad Bridges	143,000	320,000	110,000	313,000			886,000
Chgs.in Street Rys.	10,800	47,000		6,000			63,800
Chgs.in other utilities	28,500	54,000		1,500	1,200		86,200
Add 20%,Detailed as above	36,700	93,200	36,200	86,700	200		253,000
	220,000	559,200	217,200	520,200	1,400		1,518,000
GRAND TOTALS	$1,597,600	$4,613,300	$780,900	$1,371,500	$1,692,000	$3,561,600	$13,616,900



Flood Flow Volume	Units	Scioto River	Olentangy River	May St
Above Sandusky St	Cu Ft Sec	85,500		
Sandusky St to Mound St	"	50000		
Below Mound St	"			
Above Dublin Ave	"		64,500	
May St	"			100,000
Total	"	200000		
Velocity of Flow	Ft per Sec			
Between Bridges		8	8	8
Under "		10	10	10
Cross Section of Flow	Sq. Ft			
Between Bridges		6250 to 6700	8600	12,500
Under "		5000 to 8550	6450	10,000
Clear Height				
Flood Water to Bridges	Ft.	4	4	4
Levees				
Height above Flood Water	Ft.	12	6	12
Top Width	"	100	100	100
Side Slopes	"	1 on 3	1 on 3	1 on 3
Detaining Reservoirs- Capacity: 50,000 sec ft				

Flood Water Levels	1913	Future
Elevation above City Datum		
Scioto River- Grandview Ave.	51 5	46 0
Sandusky St	48 0	40 2
Broad St	45 0	37 5
Mound St		35 5
City R.R. Bridge	30 2	31 5
Olentangy Riv- Dodridge Ave.	57 5	51 7
Goodale "	55 0	41 8
C.C.C. & St.L. R.R. Bridge		40 2
Dublin Ave.		39 7

PROJECT No. 6.

Showing
The Main Features Of Design
CAPACITY 200000 C.F.S.
UNIMPROVED CHANNEL AROUND BEND
RESERVOIR AND MAY ST. CUT OFF

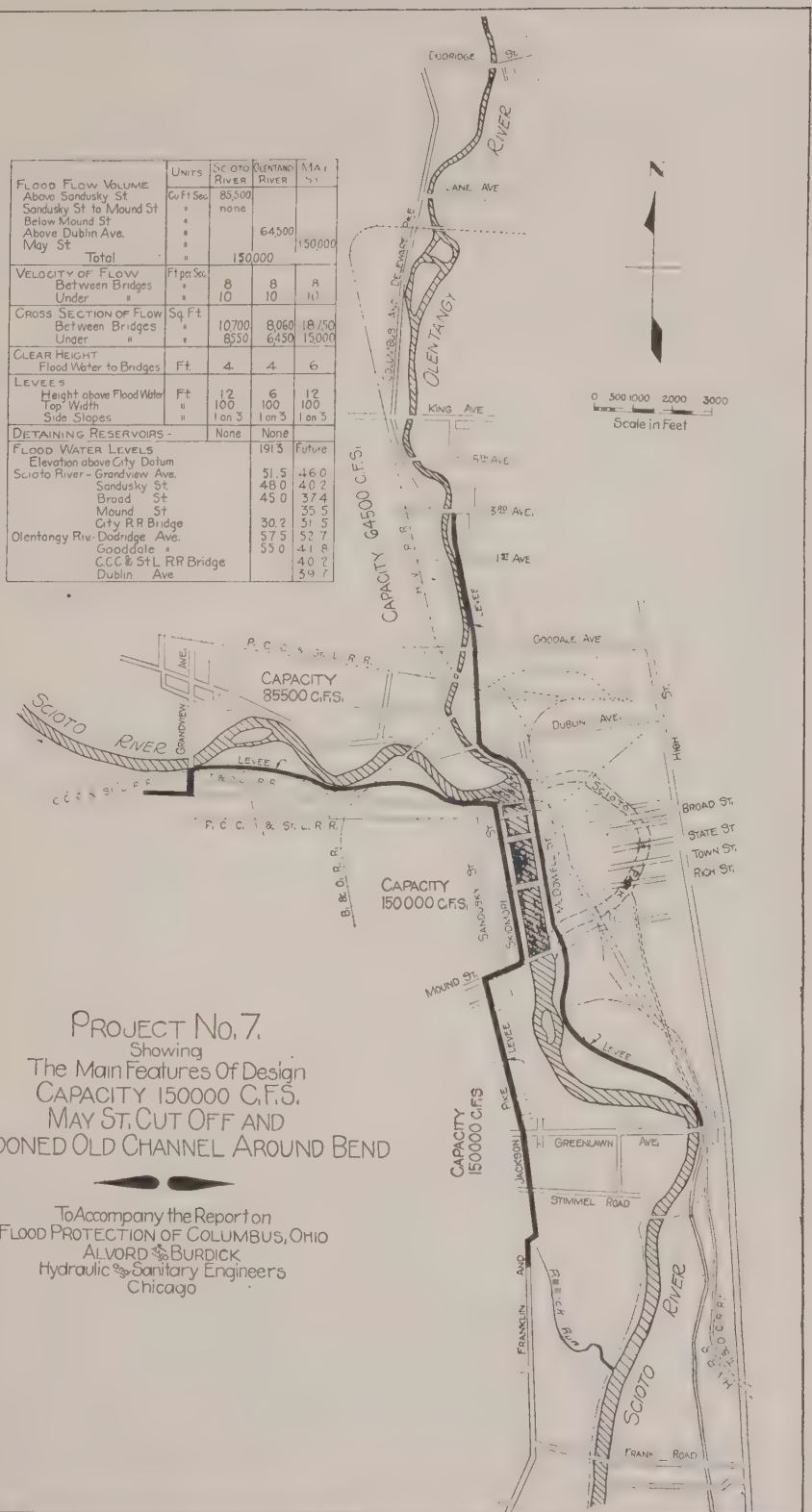
To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK
Hydraulic & Sanitary Engineers
Chicago

877.

PROJECT NO. 7.

PROVIDING FOR A FLOOD OF 150,000 SECOND FEET BY OPENING A NEW CHANNEL ACROSS THE WEST SIDE BETWEEN MCDOWELL AND SKIDMORE STREETS AND ABANDONING AND FILLING UP THE PRESENT BED OF THE RIVER AROUND THE BEND.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy River	Section "F" Scioto south of Mound St.	Totals
Preliminary Expense 1%	$8,500	$46,400	$4,700	$7,100	$14,100	$80,800
Land		2,201,800	45,000	310,800	530,400	3,088,000
Direct Damages		60,000				60,000
Temporary Bridges & Streets	4,000	42,000				46,000
Changes in Water Pipes		24,400				24,400
Changes in Sewers	100,000	86,400				186,400
Changes in Lighting	2,000	3,900				5,900
Excavation		1,302,500	389,000	102,500	622,000	2,416,000
Bridges	368,000	751,000	4,200	166,000		1,289,200
Dams and Weirs	306,000		20,000	66,000	90,000	482,000
Control Gates					11,200	11,200
Raising Streets & New Streets	70,800	184,800	11,500	64,200	107,100	418,500
Repairing Levees					48,100	48,100
Administration by Commission 2%	17,000	92,700	9,400	14,200	28,200	161,500
Engineering & Superintending 6%	51,100	278,300	28,200	42,500	84,500	484,500
Loss of Interest dur.Constr. 3%	25,500	139,100	14,100	21,300	42,300	242,300
Contin.& Indirect Damages 5%	68,100	370,900	37,800	56,700	112,700	646,000
	1,021,100	5,564,100	563,700	851,300	1,690,600	9,690,800
Changes in Railroads		45,000	71,000	113,000		229,000
Railroad Bridges	58,000	445,000	110,000	313,000		926,000
Changes in Street Railways	10,800	48,600		6,000		65,400
Changes in other Utilities	29,500	57,800		1,500	1,200	90,000
Add 20%, Detailed as above	18,700	119,300	36,200	86,700	200	262,100
	118,000	715,700	217,200	520,200	1,400	1,572,500
GRAND TOTALS	1,139,100	6,279,800	780,900	1,371,500	1,692,000	11,263,300



Flood Flow Volume	Units	Scioto River	Olentangy River	Main St.
Above Sandusky St	Cu. Ft. Sec.	85,500		
Sandusky St to Mound St	"	none		
Below Mound St	"		64,500	
Above Dublin Ave.	"			
May St	"			150,000
Total	"	150,000		
Velocity of Flow	Ft. per Sec.			
Between Bridges	"	8	8	8
Under "	"	10	10	10
Cross Section of Flow	Sq. Ft.			
Between Bridges	"	10700	8,060	18,750
Under "	"	8550	6450	15,000
Clear Height Flood Water to Bridges	Ft.	4	4	6
Levees				
Height above Flood Water	Ft.	12	6	12
Top Width	"	100	100	100
Side Slopes	"	1 on 3	1 on 3	1 on 3
Detaining Reservoirs -		None	None	

Flood Water Levels Elevation above City Datum	1913	Future
Scioto River - Grandview Ave.	51.5	46.0
Sandusky St.	48.0	40.2
Broad St.	45.0	37.4
Mound St.		35.5
City R.R. Bridge	30.2	31.5
Olentangy Riv. - Dodridge Ave.	57.5	52.7
Goodale "	55.0	41.8
C.C.C. & St.L. R.R. Bridge		40.2
Dublin Ave		39.7

PROJECT No. 7.

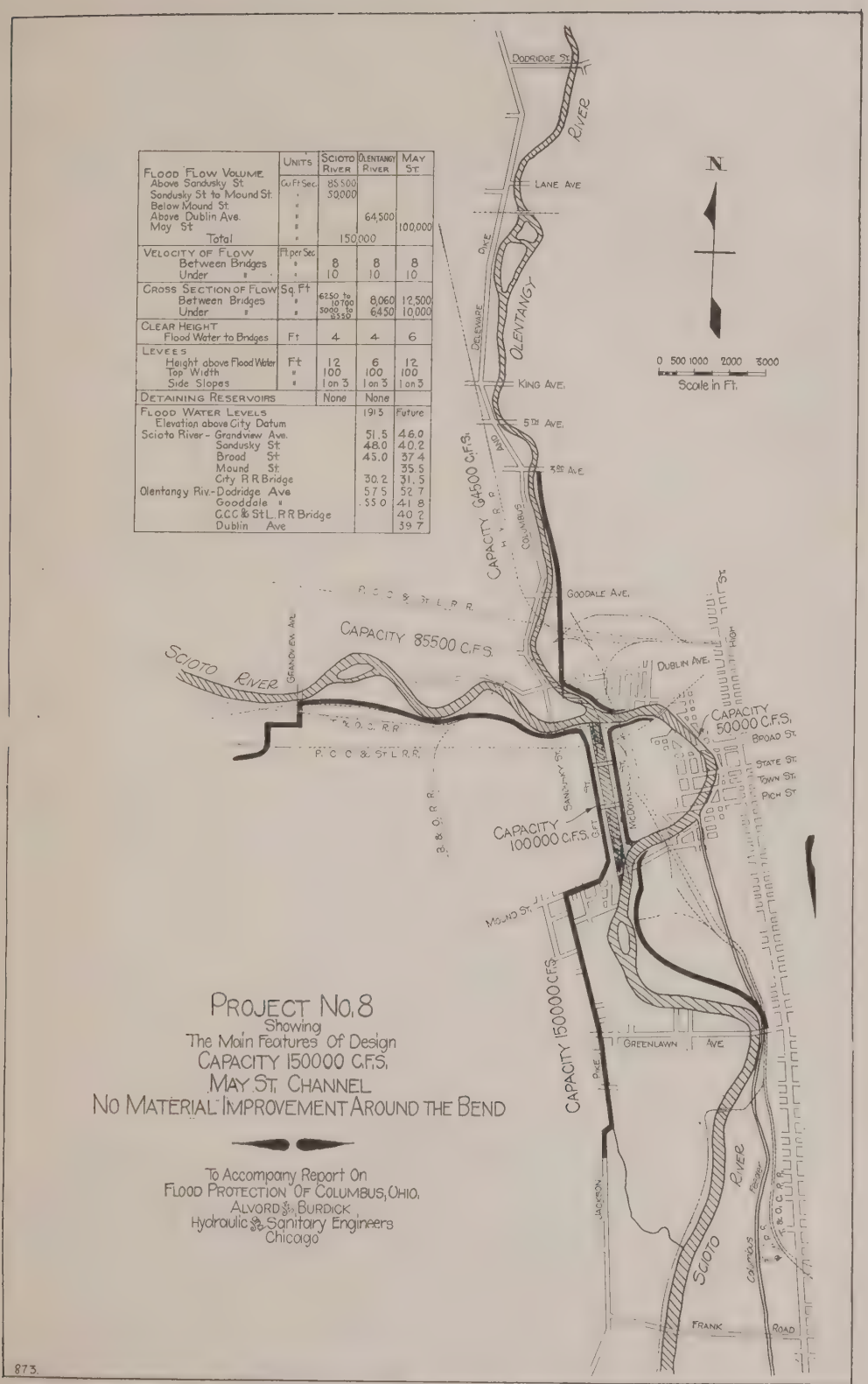
Showing
The Main Features Of Design
CAPACITY 150000 C.F.S.
MAY ST. CUT OFF AND
ABANDONED OLD CHANNEL AROUND BEND

To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO
ALVORD & BURDICK
Hydraulic & Sanitary Engineers
Chicago

PROJECT NO. 8.

PROVIDING FOR A FLOOD OF 150,000 CUBIC FEET PER SECOND BY USING THE OLD CHANNEL FOR 50,000 CUBIC FEET AND CARRYING THE REMAINING 100,000 CUBIC FEET THROUGH A NEW CHANNEL BETWEEN MCDOWELL AND GIFT STREETS.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy North of Dublin	Section "F" Scioto south of: Mound	Totals
Preliminary Expense 1%	$12,000	$33,900	$4,700	$7,100	$14,100	$71,800
Land		1,771,300	45,000	310,800	530,400	2,657,500
Direct Damages		60,000				60,000
Temporary Bridges & Streets	38,000	42,000				80,000
Changes in Water Pipes		24,400				24,400
Changes in Sewers		86,400				86,400
Changes in Lighting	2,000	3,900				5,900
Excavation		728,000	389,000	102,500	622,000	1,841,500
Bridges	779,000	544,000	4,200	166,000		1,493,200
Walls						
Dams and Weirs	306,000		20,000	66,000	90,000	482,000
Control Gates					11,200	11,200
Raising Streets & New Streets	70,900	130,800	11,500	64,200	107,100	384,500
Repairing Levees					48,100	48,100
Administration by Commission 2%	24,000	67,800	9,400	14,200	28,200	143,600
Engineering & Superintending 6%	71,800	203,400	28,200	42,500	84,500	430,400
Loss of Interest dur.Constr. 3%	35,800	101,800	14,100	21,300	42,300	215,300
Contin.& Indirect damages 8%	95,700	271,300	37,600	56,700	112,700	574,000
	1,435,200	4,069,000	563,700	851,300	1,690,600	8,609,800
Changes in Railroads		45,000	71,000	113,000		229,000
Railroad Bridges	137,000	320,000	110,000	313,000		880,000
Changes in Street Railways	10,800	47,000		6,000		63,800
Changes in other Utilities	29,500	54,000		1,500	1,200	86,200
Add 20%. Detailed as above	35,500	93,200	36,200	86,700	200	251,800
	212,800	559,200	217,300	520,200	1,400	1,510,800
GRAND TOTALS	$1,648,000	$4,628,200	$780,900	$1,371,500	1,692,000	10,120,600



Flood Flow Volume	Units	Scioto River	Olentangy River	May St.
Above Sandusky St.	Cu. Ft. Sec.	85,500		
Sandusky St. to Mound St.	"	50,000		
Below Mound St.	"			
Above Dublin Ave.	"		64,500	
May St.	"			100,000
Total	"	150,000		
Velocity of Flow	Ft. per Sec.			
Between Bridges	"	8	8	8
Under "	"	10	10	10
Cross Section of Flow	Sq. Ft.			
Between Bridges	"	6250 to 10700	8,060	12,500
Under "	"	3000 to 8350	6450	10,000
Clear Height				
Flood Water to Bridges	Ft.	4	4	6
Levees				
Height above Flood Water	Ft.	12	6	12
Top Width	"	100	100	100
Side Slopes	"	1 on 3	1 on 3	1 on 3
Detaining Reservoirs		None	None	
Flood Water Levels			1913	Future
Elevation above City Datum				
Scioto River - Grandview Ave.			51.5	46.0
Sandusky St.			48.0	40.2
Broad St.			45.0	37.4
Mound St.				35.5
City R.R. Bridge			30.2	31.5
Olentangy Riv. - Dodridge Ave.			57.5	52.7
Goodale "			55.0	41.8
C.C.C. & St.L. R.R. Bridge				40.2
Dublin Ave.				39.7

PROJECT No. 8

Showing
The Main Features Of Design
CAPACITY 150000 C.F.S.
MAY ST. CHANNEL
NO MATERIAL IMPROVEMENT AROUND THE BEND

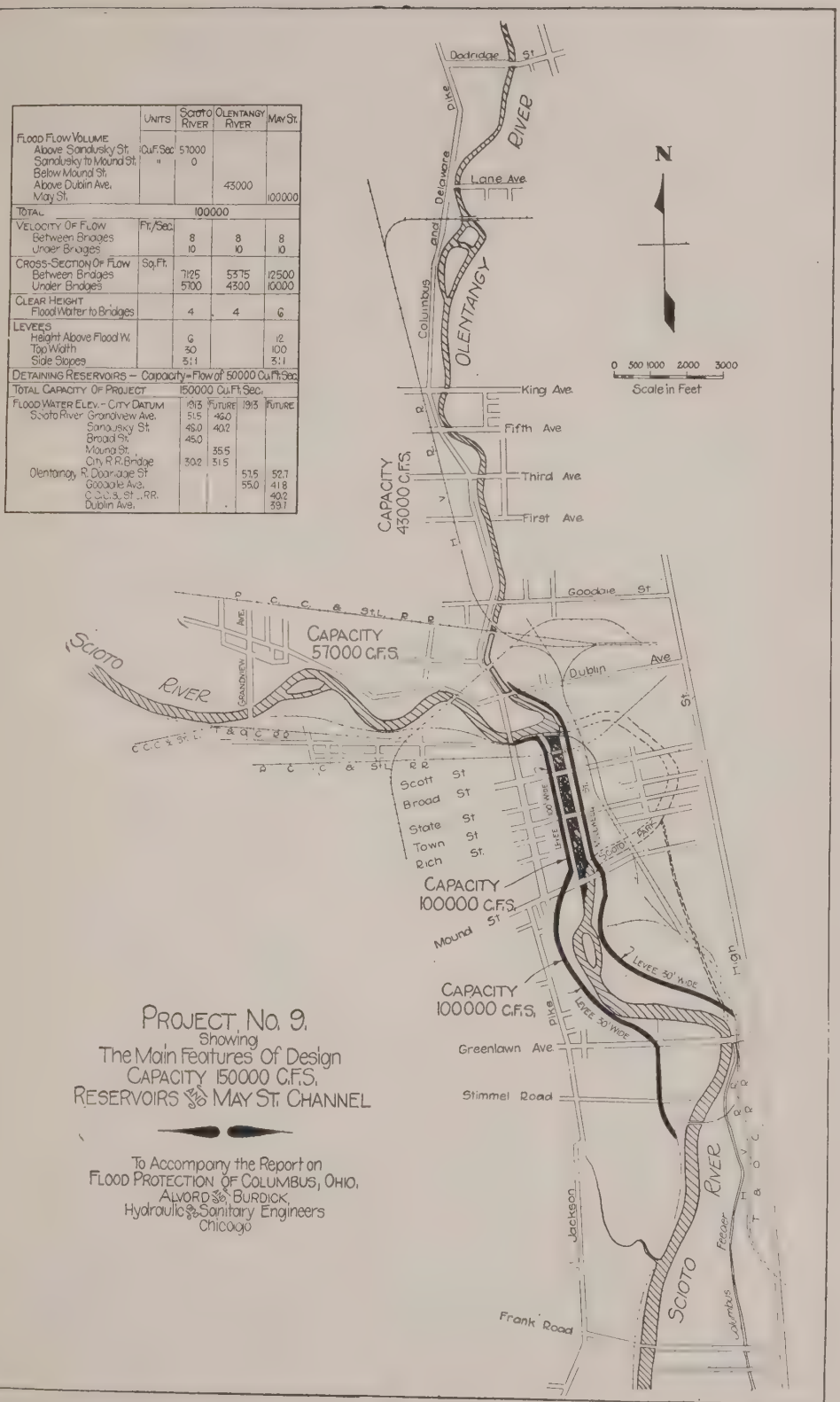
To Accompany Report On
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK
Hydraulic & Sanitary Engineers
Chicago

873.

PROJECT NO. 9.

PROVIDING FOR A FLOOD OF 150,000 CUBIC FEET PER SECOND BY BUILDING RESERVOIRS AT DUBLIN AND DELAWARE TO DETAIN 50,000 CUBIC FEET PER SECOND AND PROVIDING A NEW CHANNEL BETWEEN MCDOWELL AND GIFT STREETS TO CARRY 100,000 CUBIC FEET PER SECOND AND ABANDONING THE PRESENT CHANNEL AROUND THE BEND.

	Section "A" Mound to Sandusky	Section "B" May St. Cut-off	Section "D" Scioto above Sandusky	Section "E" Olentangy north of Dublin	Section "F" Scioto south of Mound	Reservoirs	Totals
Preliminary Exp. 1%	$6,400	$33,800	$1,100	$6,200	$7,700	$29,700	$84,900
Land		1,771,300	45,000	310,800	392,000	1,094,000	3,613,100
Direct Damages		60,000					60,000
Temporary Bridges and Streets	4,000	42,000					46,000
Chgs. in Water Pipes		12,000					12,000
Chgs. in Sewers	100,000	86,400					186,400
Chgs. in Lighting	1,000	3,800					4,800
Excavation		728,000			266,000		994,000
Bridges	272,000	544,000	35,000	281,000	57,000		1,189,000
Dams and Weirs	225,000		20,000			1,874,000	2,119,000
Raising Streets and new Streets	40,400	130,800	2,000	20,000	55,000		248,200
Repairing Levees					4,000		4,000
Administration by Commission 2%	12,800	67,600	2,000	12,400	15,500	59,400	169,700
Engr. & Supt. 6%	38,600	202,700	6,200	37,300	46,400	178,100	509,300
Loss of Intr. dur. Construction 3%	19,300	101,300	3,000	18,700	23,200	89,000	254,500
Cont. and indirect damages 8%	51,400	270,300	8,200	49,700	61,800	237,400	678,900
	770,900	4,054,100	122,500	746,100	928,700	3,561,600	10,183,900
Chgs. in Railroads		45,000		113,000			158,000
Railroad bridges		320,000	41,000	274,000			635,000
Chgs. in Street Rys.	10,800	47,000		2,400			60,200
Chgs. in other Utilities	28,500	54,000					83,500
Add 20%, Detailed as above	8,100	93,200	8,200	77,800			187,400
	48,400	559,200	49,200	467,300			1,124,100
GRAND TOTALS	$819,300	$4,613,300	$171,700	$1,213,400	$928,700	$3,561,600	$11,308,000



	Units	Scioto River	Olentangy River	May St.
Flood Flow Volume				
Above Sandusky St.	C.F.S. Sec.	57000		
Sandusky to Mound St.	"	0		
Below Mound St.				
Above Dublin Ave.			43000	
May St.				100000
Total		100000		
Velocity Of Flow	Ft./Sec.			
Between Bridges		8	8	8
Under Bridges		10	10	10
Cross-Section Of Flow	Sq. Ft.			
Between Bridges		7125	5375	12500
Under Bridges		5700	4300	10000
Clear Height				
Flood Water to Bridges		4	4	6
Levees				
Height Above Flood W.		6		12
Top Width		30		100
Side Slopes		3:1		3:1
Detaining Reservoirs — Capacity=Flow of 50000 Cu. Ft. Sec.				
Total Capacity Of Project		150000 Cu. Ft. Sec.		

Flood Water Elev. - City Datum	1913	Future	1913	Future
Scioto River Grandview Ave.	51.5	46.0		
Sandusky St.	45.0	40.2		
Broad St.	45.0			
Mound St.		35.5		
C.H. & P.R. Bridge	30.2	31.5		
Olentangy R. Goodale St.			51.5	52.7
Goodale Ave.			55.0	41.8
C.C.C.& St. L. RR.				40.2
Dublin Ave.				39.7

PROJECT No. 9.

Showing
The Main Features Of Design
CAPACITY 150000 C.F.S.
RESERVOIRS & MAY ST. CHANNEL

To Accompany the Report on
FLOOD PROTECTION OF COLUMBUS, OHIO.
ALVORD & BURDICK,
Hydraulic & Sanitary Engineers
Chicago

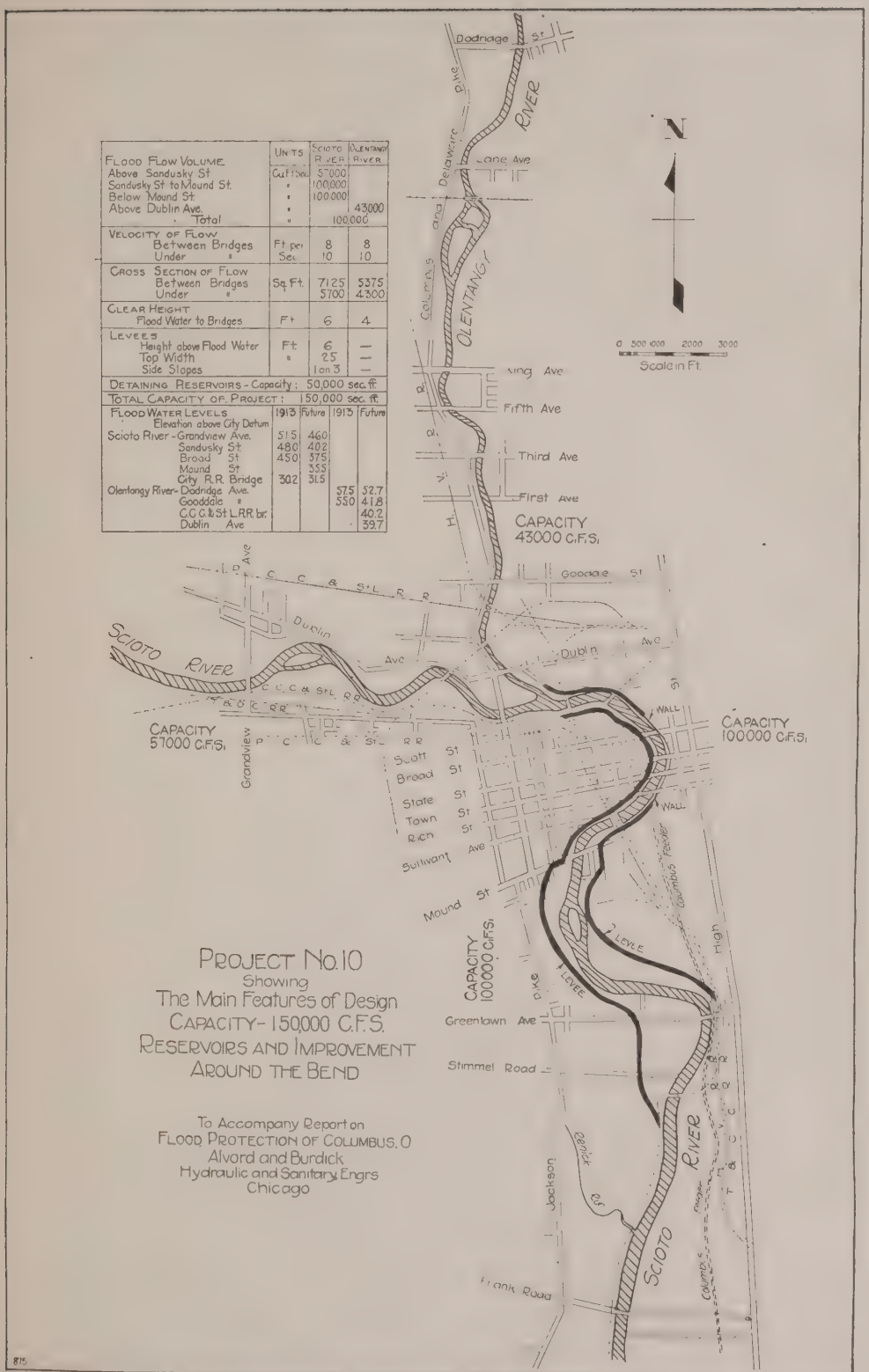
879

PROJECT NO. 10.

PROVIDING FOR A FLOOD OF 200,000 CUBIC FEET FLOW BY

DEEPENING PRESENT CHANNEL AND PROVIDING RESERVOIRS ABOVE DUBLIN AND DELAWARE.

	Section "A" Mound St. to Sandusky	Section "D" Scioto above Sandusky	Section "E" Olentangy River	Section "F" Scioto south of Mound	Reservoirs Delaware and Dublin	Totals
Preliminary Expense 1%	$38,800	$1,000	$6,200	$7,700	$29,700	$83,600
Land	1,178,800	45,000	310,800	392,000	1,094,000	3,039,600
Direct Damages	60,000					60,000
Temporary Bridges and Streets	50,000					50,000
Changes in Water Pipes	13,200					13,200
Changes in Sewers	1,500					1,500
Changes in Lighting	2,200					2,200
Excavation	1,128,000			266,000		1,394,000
Bridges	1,085,000	35,000	291,000	57,000		1,468,000
Walls	72,000					72,000
Dams and Weirs	198,000	20,000			1,874,000	2,092,000
Raising Streets and New Streets	90,500	2,000	20,000	55,000		167,500
Repairing Levees				4,000		4,000
Administration by Commission 2%	77,600	2,000	12,400	15,500	59,400	167,300
Engineering & Superintending 6%	232,700	6,200	37,300	46,400	178,100	501,800
Loss of Interest during Const. 3%	116,400	3,000	18,700	23,200	89,000	250,900
Contingencies and indirect damages 8%	331,300	8,200	49,700	61,800	237,400	690,000
	4,856,000	122,400	748,100	928,700	3,561,600	10,014,800
Changes in Railroads	106,500		113,000			219,500
Railroad Bridges	440,000	41,000	274,000			755,000
Changes in Street Railways	20,400		2,400			22,800
Changes in Other Utilities	40,100					40,100
Add 20%, Detailed as above	121,400	8,200	77,900			207,500
	728,400	49,200	467,300			1,244,900
GRAND TOTALS	$5,384,400	$171,600	1,213,400	$928,700	$3,561,600	$11,259,700



Flood Flow Volume	Units	Scioto River	Olentangy River
Above Sandusky St.	Cu. Ft. per Sec.	57000	
Sandusky St to Mound St.	"	100000	
Below Mound St.	"	100000	
Above Dublin Ave.	"		43000
Total	"	100000	
Velocity of Flow			
Between Bridges	Ft. per Sec.	8	8
Under "	"	10	10
Cross Section of Flow			
Between Bridges	Sq. Ft.	7125	5375
Under "	"	5700	4300
Clear Height			
Flood Water to Bridges	Ft.	6	4
Levees			
Height above Flood Water	Ft.	6	—
Top Width	"	25	—
Side Slopes		1 on 3	—
Detaining Reservoirs - Capacity:		50,000 sec. ft.	
Total Capacity of Project:		150,000 sec. ft.	

Flood Water Levels Elevation above City Datum	1913	Future	1913	Future
Scioto River - Grandview Ave.	515	460		
Sandusky St.	480	402		
Broad St.	450	375		
Mound St.		355		
City R.R. Bridge	302	315		
Olentangy River - Dodridge Ave.			575	527
Goodale "			550	418
C.C.C.&St.L.R.R. br.				402
Dublin Ave				397

PROJECT No. 10

Showing
The Main Features of Design
CAPACITY - 150,000 C.F.S.
RESERVOIRS AND IMPROVEMENT
AROUND THE BEND

To Accompany Report on
FLOOD PROTECTION OF COLUMBUS, O.
Alvord and Burdick
Hydraulic and Sanitary Engrs
Chicago

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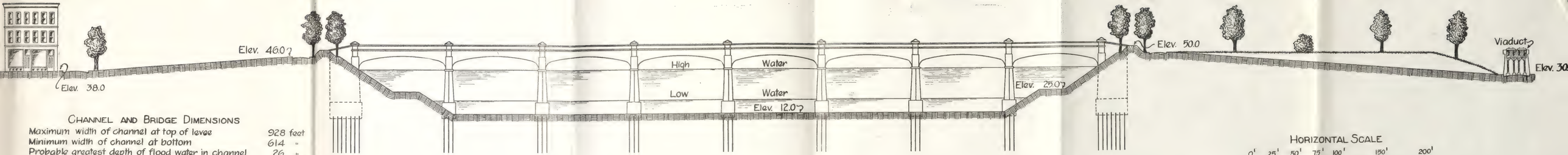


ELEVATION

HORIZONTAL SCALE

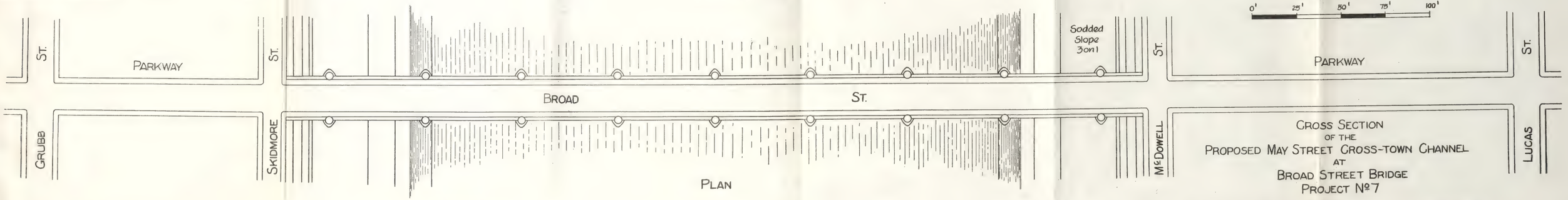
0' 25' 50' 75' 100' 150' 200'

VERTICAL SCALE

0' 25' 50' 75' 100'

CHANNEL AND BRIDGE DIMENSIONS

Maximum width of channel at top of levee	928 feet
Minimum width of channel at bottom	614 "
Probable greatest depth of flood water in channel	26 "
Distance between abutments of bridge	864 "
Distance between center lines of pears	108 "
Clear span between peers	100 "



PLAN

CROSS SECTION
OF THE
PROPOSED MAY STREET CROSS-TOWN CHANNEL
AT
BROAD STREET BRIDGE
PROJECT Nº 7

TO ACCOMPANY REPORT ON FLOOD PROTECTION OF COLUMBUS, OHIO
Alvord and Burdick—Hydraulic and Sanitary Engineers
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